ABSTRACTS

07384 **Abdel-Aal, Farouk Mostafa.** Extension of bed-load formulas to high sediment rates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1989B, 1970.

07248 **Abdel-Hady, M.; Abdel-Hafez, M. A.; Karbs, Harlan H.** Subsurface drainage mapping by airborne infrared imagery techniques: Oklahoma Acad. Sci. Proc. 1970, v. 50, p. 10-18, illus., 1970.

Infrared (IR) radiation is one of the most useful regions of the electromagnetic spectrum for remote sensing for engineering purposes and there has been increasing awareness of its potential applications. Ground exploration methods have limitations and are increasingly costly. Economics may be the catalyst that accelerates the use of remote sensing for solving various engineering problems. Hidden subsurface conditions that influence planning and design of engineering structures can be exposed with IR instrumentation. The location of subsurface muck pockets, entrapped moisture in natural slopes, underground cavities and conduits, and subsurface drainage systems can all be exposed with IR imagery. — *from* Authors' abstract

Abdel-Hafez, M. A. *See* Abdel-Hady, M. 07248

07338 **Adachi, Toshihisa.** Construction of continuum theories for rock by tensor testing [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1939B, 1970.

07449 **Adachi, Toshihisa; Serata, Shosei; Sakurai, Shunsuke.** Determination of underground stress field based on inelastic properties of rocks, Chap. 18 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 293-328, illus., tables, 1970.

A viscoelastic method of determining the in-situ stress field by relating time-dependent behavior of the borehole with tensor properties and initial stress field of the underground prior to drilling is described. The development of the technique including theoretical derivation, laboratory determination of tensor properties of halite, instrument, design, and field measurements is discussed. The borehole creepmeter developed measures viscoelastic behavior of boreholes with an accuracy of the order of 10^{-6} in. The natural stress field in Prairie evaporite of Saskatchewan, was determined at a depth of 3400 feet. A laboratory method for tensor analysis of rock media was developed to determine the true, three-dimensional coefficients of elasticity, viscoelasticity, and viscoplasticity of materials; a rheological model of the halite was developed from this tensor analysis and used for numerical calculation of field data. — VSN

07305 **Afifi, Sherif El-Sayed Ahmed.** Effects of stress history on the shear modulus of soils [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2660B-2661B, 1970.

Agnihotri, N. P. *See* Dixon, J. B. 07433

07260 **Al-Agidi, Waleed Khalid Hassan.** A chronolithosequence of soils on Pleistocene terraces along Maple River in northeastern Clinton County, Michigan, U.S.A. (their morphologic, genetic and geomorphic interrelationship) [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2411B, 1970.

07495 **Alf, Raymond M.** A preliminary report on a Miocene flora from the Barstow Formation, Barstow, California: Southern California Acad. Sci. Bull., v. 69, nos. 3-4, p. 183-188, illus., 1970.

Although the vertebrate fauna and the rocks of the Barstow Formation have been thoroughly studied, no fossil plants have been reported previously. Petrified wood and leaves have been found recently at three localities near Barstow, San Bernardino County, Calif. The wood fragments occur in the upper Miocene Sky Line Tuff member; thin sections show cellular structures of *Juniperus* sp., *Rhus*,, *Ceanothus*,, and an unknown shrub. Identifiable leaves, preserved as impressions in lacustrine siltstones and calcareous mudstones, include part of a palm frond, species of oak similar to *Quercus convexa* and *Q. dayana*, and other oak species. There are also some seeds and possible acorn cups. The flora seems to represent a chaparral. — VMJ

07225 **Alizai, Hamid Ullah; Hulbert, L. C.** Effects of soil texture on evaporative loss and available water in semi-arid climates: Soil Sci., v. 110, no. 5, p. 328-332, illus., tables, 1970.

Experiments by the authors have confirmed that more water evaporates from fine-textured than from coarse-textured soils. The difference in evaporation helps to explain why mesophytic vegetation is on coarse- rather than fine-textured soils in a semi-arid and arid region. — JWH

07577 **Al-Layla, Mohamad Tayeb Hussain.** Study of certain geotechnical properties of Beaumont Clay [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1258B, 1970.

Allen, B. L. *See* Ratliff, L. F. 07221

Allen, George E. *See* Socolow, Arthur A. 07487

07380 **Allen, Ralph Orville, Jr.** Multi-element neutron activation analysis — Development and application to a trace element study of the Bruderheim chondrite [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1772B, 1970.

00229 **Amsden, Thomas W.; Rowland, T. L.** Silurian and Lower Devonian (Hunton) oil-and-gas producing formation: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 104-109, illus., 1971.

Hunton strata in central Oklahoma produce from rocks of Devonian age supplemented by yields from rocks of Silurian age. Production from the Hunton in western Oklahoma is mostly from Silurian age rocks. In much of central and western Oklahoma, Hunton limestone and dolomite of Silurian age underlies the Woodford. Porosity appears to be the result of dolomitization. — SEF

Anderson, Fred A. *See* Wallace, George B. 07455

07519 **Anderson, Raymond J.; Egleson, G. C.** Discovery of potash in the A-1 Salina salt in Michigan, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 15-19, illus., table, 1970.

Bromine and potassium contents of salt from a well core at Midland, Mich., were determined on 120 samples representing A-1 Salina salt from the stratigraphic interval between 8,287 and 8,392 feet. Fifty additional samples covering depths from 8,150 to 8,600 feet, were analyzed for bromine only. Bromine values range from less than 50 to 1,600 ppm, potassium values as K_2O from less than 0.5 to more than 40 percent. The 92-ft interval between 8,295 and 8,387 feet is estimated to contain an average of about 4 percent K_2O, whereas the average for three 5-15-ft sections within this interval is appreciably higher. The potash profile correlates well with a gamma log run through the section some 11 mi southwest of the Midland well, the bromine profile with one obtained from cuttings from a well some 45 mi to the north. The sylvinite occurrence is somewhat unusual in that neither magnesium nor sulfate is present in appreciable amounts. — *from* Authors' abstract

07520 **Anderson, Raymond J.; Majeske, E. C.** Detection of potash zones by drilling fluid analysis, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 34-36, illus., 1970.

By analyzing drilling fluid for percent of potassium, and knowing the drilling and pumping rate, it was calculated that in the Salina A-1 Salt of Silurian age in the Michigan Basin a 6.2 foot bed averaging 7.3 percent sylvite (KCl) exists at a depth of 5,045 feet in the No. 1 Parmeter, Kent County, Mich. Confirmation of these calculations was found on the gamma-ray log when it was released a few months later. This inexpensive method for detecting potassium minerals can be used when a well is scheduled to penetrate a salt section. Drilling fluid samples should be taken every two minutes in order that a zone is not missed. To reduce the number of samples sent out for assay a semi-quantitative screening test for potassium can be used. — *from* Authors' abstract

00209 **Andrews, James E.** Abyssal hills as evidence of transcurrent faulting on North Pacific fracture zones: Geol. Soc. America Bull., v. 82, no. 2, p. 463-469, illus., 1971.

A recent study of abyssal hills in the North Pacific has shown that some hills can be formed by local tectonism and volcanism in the crustal plate at some distance from the ridge crest. Hills formed under these circumstances are larger than those formed at the ridge crest, and show lineations parallel to or oblique to the fracture zones bounding the crustal segments. Strike-slip motion along the fracture zones due to differential spreading rates is apparently responsible for the development of the hills. An application of structural analyses to the hills may help to define periods of more active spreading. — Author's abstract

07263 **Anessi, Thomas Joseph.** Strength and consolidation properties of raw and stabilized Oklahoma shales [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2661B, 1970.

07325 **Anisgard, Harry W.** Causes of dominantly arenaceous foraminiferal assemblages in downdip Wilcox of Louisiana, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 210-217, illus., 1970.

Studies of cores and cuttings from 9 wells reveal a predominantly *Haplophragmoides-Trochammina-Ammomarginulina* assemblage. *Spiroplectammina*, *Bigenerina*, and *Bathyalphon* occur less frequently. These forms are best represented in the more shaly and deeper-water intervals of a marginal, shallow-marine section deposited under the influence of intermittently active deltaic conditions. Foraminifera, lithology, minerals, sedimentary structures, and electric log character reflect persistently shallow and turbid water with low-oxygen and high organic content resulting in a reducing paleoenvironment. The water chemistry inhibited $CaCO_3$ formation and the presence in quantity of calcareous Foraminifera. An abundant supply of clastic material and the lack of competition from calcareous types caused arenaceous Foraminifera to prevail in Wilcox microfossil populations. — Author's abstract

07378 **Anstey, Robert Leland.** The trepostome bryozoan fauna of the Eden Shale (Ordovician) in southeastern Indiana and adjacent areas in Kentucky and Ohio [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2157B, 1970.

07303 **Anthony, Gaylord Dean.** Studies of the thermal decomposition of kaolin and sediments [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2519B, 1970.

Arbingast, Stanley A. *See* Bonine, Michael E. 07191

Archambault, G. *See* Ladanyi, B. 07508

00218 **Aristarain, L. F.** Clay minerals in caliche deposits of eastern New Mexico: Jour. Geology, v. 79, no. 1, p. 75-90, illus., tables, 1971.

Relative amounts of clay minerals were determined in samples from 12 profiles of caliche deposits, representing five geomorphic areas. Illite, montmorillonite, and

kaolinite are dominant; the amounts of chlorite and mixed-layer clay minerals are relatively insignificant. In mature caliche profiles, illite is most abundant, increasing from bottom to top to become 63-94 percent of the clay minerals in the upper parts; relative amounts of montmorillonite and kaolinite, whose abundances are very similar, decrease proportionally. Based on dominant clay minerals and their distributions, some similarities exist between caliche deposits and chernozem and desert soils. — VES

00261 **Armitage, Bruce; Zeitlin, Harry.** The preconcentration of various trace elements in seawater by solvent extraction and the ring oven [with French and German abs.]: Anal. Chim. Acta, v. 53, no. 1, p. 47-53, tables, 1971.

A procedure is described for the preconcentration from sea water without pretreatment of six trace elements, uranium, copper, nickel, cobalt, iron, and manganese, through solvent extraction with an 8-hydroxyquinoline-chloroform mixture. Extracted samples are deposited on filter-paper disks with the aid of a kinetic clamp pump and a ring oven, and the six elements are determined non-destructively by X-ray fluorescence. Evaluation of the procedure with distilled water and sea water samples spiked with the metal ions shows that extraction of the trace elements is essentially quantitative. — Authors' abstract

07336 **Arora, Harpal Singh.** Clay dispersion as influenced by chemical environment and mineralogical properties [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1646B, 1970.

07198 **Asher, R. R.** Geochemistry and geology, Boundary area, Fortymile district, Eagle A-1 quadrangle, Alaska: Alaska Div. Mines and Geology Geochem. Rept. 23, 35 p., illus., tables, 1970.

In this area on the Taylor Highway, recent work has shown that metamorphic rocks, earlier referred to as Birch Creek Schist of Precambrian age, may in part be Paleozoic; mapping was done on the basis of lithology with no use of formal stratigraphic units. There are also ultramafic rocks in the area. Subjected to several episodes of metamorphism, at least three directional trends of fold axes can be recognized; tight isoclinal folds and a left lateral fault are the main structural elements. Mapping, rock sampling, and geochemical sampling reveal a possible lead-zinc deposit between Brophy and Camp Creeks. Some anomalous geochemical samples are related to lithology; copper and nickel anomalies associated with an ultramafic plug warrant further investigation. Sources of some anomalous samples are probably in Yukon. — *from* Author's abstract

Ault, Curtis H. *See* Rooney, Lawrence F. 07484

00288 **Austin, Herbert M.** Shell debris and shoreline energy on Florida gulf beaches: Florida Acad. Sci. Quart. Jour., v. 33, no. 2, p. 90-96, illus., tables, 1970 [1971].

A technique for estimating energy level and average breaker height from unconsolidated shoreline substrate provides an alternate, complementary method to that of Tanner (1960) for estimating relative energy levels. Shell debris from the high-tide swash mark was collected from seven localities on the Florida Panhandle coast; the correlation coefficient was determined for the modal size of shell hash versus Tanner's transverse energy levels and longitude. Decrease in shell-hash size is inversely correlated to increase in breaker height. On a higher-energy beach (as along spits) the source of shell material is within the zone of deposition; in lower-energy environments the shell source is offshore. Shell-debris substrate along zero- through moderate-energy coasts can give a reasonably accurate estimate of average breaker heights, as it does not reflect the short-term variations in energy. — VMJ

07543 **Avery, Gleason G.; Luther, Edward T.** Mineral resources summary of the Norma quadrangle, Tennessee: Nashville, Tenn., Tennessee Div. Geology, 18 p., tables, 1970.

The only mined mineral resource in the Norma quadrangle is coal; coal-bearing rocks underlie the entire quadrangle. The youngest unit is the Middle Pennsylvanian Frozen Head Sandstone Member of the Vowell Mountain Formation, beneath which there is about 3,000 feet of Pennsylvanian age rocks; oldest rocks exposed are the upper formations of the Lower Pennsylvanian Crooked Fork Group. This text accompanies Tennessee Div. Geology Geol. Map GM 128-SW by Luther and Avery (cited separately); this set of maps contains 5 coal maps, seams of which are described in the text. — MCM

Avery, Gleason G. *See* Luther, Edward T. 07546

07341 **Babcock, Elkanah Andrew.** Structural geology and geophysics of the Durmid area, Imperial Valley, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2056B-2057B, 1970.

07392 **Bader, John W.** When to stop drilling: Mining Eng., v. 22, no. 7, p. 115-117, illus., 1970.

An orderly sequence of drill sampling in which the density of drillhole pattern is increased by stages leads to a static shape in the sample grade frequency curve, at which point the accumulated samples will be fully representative of the ore body. — Mining Engineering abstract

07296 **Baie, Lyle Frederick.** Post-Cretaceous structures and sediment of the northeast Campeche Platform, Gulf of Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2858B, 1970.

00243 **Bain, Roger J.** An overgrowth relationship among Permian fossils from Texas: Jour. Paleontology, v. 45, no. 1, p. 134-136, illus., 1971.

The brachiopods *Derbyia* and *Hercosia* form a complex overgrowth association with a crinoid and fistuliporid bryozoan in a specimen collected from the bank facies of the Permian Cathedral Mountain Formation in [the Glass Mountains of] west Texas. The brachial valve of *Derbyia* is attached to several columnals of a crinoid column. *Hercosia* and a fistuliporid bryozoan are mutually overgrown, encrusting the valve of *Derbyia*. *Derbyia* became attached to a crinoid column in a juvenile stage and, following the death of the crinoid and *Derbyia*, was transported and then encrusted by *Hercosia* and the bryozoan. — Author's abstract

07342 **Baker, David Warren.** X-ray analysis and representation of preferred orientations in crystal aggregates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2057B, 1970.

07506 **Baker, L. E.; Sandhu, R. S.; Shieh, W. Y.** Application of elasto-plastic analysis in rock mechanics by finite element method, Chap. 14 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 237-251, illus., tables, 1970.

A general procedure for solving elast-plastic problems is presented in which a three-dimensional generalization of the Mohr-Coulomb yield criteria is used. It is shown to be quite accurate when compared to the closed-form solution for a wedge. In deep-tunnel and excavated-slope examples, effects of 'initial stresses' and pore-water pressures are included. Complex geometries and heterogeneous rock conditions can be handled just as easily as the simlified conditions assumed. The current version of the elasto-plastic program will analyze a system of up to 800 elements and provide the solution in reasonable computer time. The execution time on an 1108 Univac computer for a three-sample problem is given in a table. The finite element procedures can model actual properties of an in-situ rock mass. — *from* Authors' conclusions

07581 **Baker, Richard Graves.** Late Quaternary pollen and plant macrofossils from abandoned-lagoon sediments near Yellowstone Lake, Wyoming [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1348B-1349B, 1970.

07343 **Baker, Robert Allison, 3d.** Stratigraphy and sedimentology of the Cañon del Tule Formation (Upper Cretaceous), Parras Basin, northeastern Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2057B-2058B, 1970.

07600 **Bambach, Richard Karl.** Bivalvia of the Siluro-Devonian Arisaig Group, Nova Scotia [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1433B, 1970.

07269 **Bamford, Robert Wendell.** Genesis of the magnesite deposits of Stevens County, Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2761B-2762B, 1970.

07324 **Bandy, Orville L.** Upper Cretaceous-Cenozoic paleobathymetric cycles, eastern Panama and northern Colombia, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 181-193, illus., table, 1970.

Analysis of planktonic microfossils and benthic foraminifera indicates one deep-water depositional cycle in the Upper Cretaceous (Campanian) of northern Colombia and two major deep-water sequences in the Cenozoic (Upper Paleocene-Lower Eocene and Middle Oligocene-Lower Miocene) of northern Colombia and eastern Panama. The faunal assemblages are given. The shallowest-water facies separating the deep-water cycles (mostly neritic or upper-bathyal) are characteristic of basal Paleocene, Upper Eocene-Lower Oligocene, and Upper Miocene through Quaternary sequences, locally, beds of these ages are absent or nonmarine. Sections in the Gatun Lake area show shallow (neritic to upper bathyal at deepest) facies in the Eocene, Upper Oligocene, and Upper Miocene-Pliocene sections, separated by paralic beds or unconformities. The shallowest-water horizons of each paleobathymetric cycle may represent times conducive to the migration of land faunas. — DBV

07445 **Barla, Giovanni.** Some constitutive equations for rock materials, Chap. 13 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 221-236, illus., tables, 1970.

In using the classical theory of elasticity to analyze rock behavior discrepancies caused by physical nonlinearity, time-dependency, and anisotropy as well as anelasticity due to density and temperature changes are often neglected. These discrepancies can be analyzed theoretically by varying constitutive equations of rock material. Adequate and practical procedures of determination of the material functions entering the various equations must be established; this paper presents an attempt with respect to simulation of behavior patterns of rock material. The theory of constituent equations is reviewed and the general three-dimensional equation for a homogeneous and isotropic rock material exhibiting time-dependent behavior is developed. The problem of a circular opening in an infinite plane body under uniaxial stress at infinity is considered to illustrate the effect of changing the constitutive equations. — VSN

07404 **Barnes, Hubert L.; Lavery, Norman G.** Primary metal dispersion as an indicator of mineralization [abs.]: Mining Eng., v. 22, no. 9, p. 50, 1970.

07270 **Barnes, Marvin Peterson.** Porphyry copper deposits — A computer analysis of significance of geological parameters [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2762B, 1970.

Barnhisel, R. I. *See* Ellis, J. H. 07624

07234 **Barr, D. J.; Swanston, D. N.** Measurement of creep in a shallow, slide-prone till soil: Am. Jour. Sci., v. 269, no. 5, p. 467-480, illus., tables, 1970.

Strain probe measurements of creep in a steep slope, glacial till soil were made in an area of active soil movement in southeastern Alaska. Estimates of creep from accumulate data indicate rates in excess of 0.06 m per year at the surface, rapidly decreasing to zero at an impermeable lower soil boundary. The soil apparently moves as a

flow mass with no well-defined shear zones. Inferences from probe data and deformation of paraffin rods installed in active slopes suggest that movement exists the year round with the highest rate of movement occurring in the fall and spring when soil moisture is highest. — Authors' abstract

00269 **Barrett, D. L.; Keen, C. E.; Manchester, K. S.; Ross, D. I.** Baffin Bay — An ocean: Nature, v. 229, no. 5286, p. 551-553, illus., table, 1971.

Both the thickness of the crust and the measured velocities in Baffin Bay, as revealed by a two-ship seismic refraction survey made in October 1970, indicate that the central deep portion of the Bay is oceanic and cannot be attributed to extended and faulted continental material. — DBV

Batchelder, George L. *See* Reger, Richard D. 00329

07595 **Bateman, Barry Lynn.** Generation of representative geologic strata suitable for simulation of fluid flow [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1382B, 1970.

Bateson, J. Howard. *See* Kesler, Stephen E. 00301

07569 **Baxter, Franklin Paul.** Sedimentology of Woodfordian glacial materials and subsequent biocycling in derived soils in a mixed forest of northeastern Wisconsin; ant pedoturbation in a prairie soil of southwestern Wisconsin [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1005B, 1970.

00311 **Bayly, M. Brian.** Similar folds, buckling, and great-circle patterns: Jour. Geology, v. 79, no. 1, p. 110-118, illus., 1971.

Buckling experiments with layered, partly anisotropic wax models yield folds that are close to 'similar' in geometry, and suggest that the same origin is possible for naturally occurring near-similar folds. Comparison of attitudes of lineation by stereographic plotting can yield clues to fold genesis. — *from* Author's abstract

07553 **Beard, David B.** Cumulative interplanetary dust concentration on the lunar surface: Modern Geology, v. 1, no. 4, p. 301-304, 1970.

It is shown that if interplanetary dust concentration has always been the same as it is at present, the maximum possible thickness of an interplanetary dust layer on the lunar surface is a few centimeters. Vaporization at time of impact makes it probable that the thickness of the dust layer is less than this upper limit by several orders of magnitude. — Author's abstract

07304 **Beaulieu, Patrick Leo.** Determination of aluminum, chromium, magnesium, and silicon in trace amounts in iron meteorites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2519B, 1970.

00250 **Beerbower, James R.** Field guide to fossils — Earth Sci. Curriculum Proj. Pamph. Ser. PS-4: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 53 p., illus., 1971.

The search for fossils includes places to collect, the appearance of fossils, and equipment needed to collect. Field observation should be done so carefully that the location can be found again, rock layers containing fossils must be described carefully, giving their position in the succession. The art of collecting and preparing fossils for study is described. Identification and classification are the next steps in preparing the collection; three appendices give the major groups of fossil plants and animals, and their relation to geologic time. Interpreting the geologic history and evolution of the fossils, and reconstructing the living plants or animals add to knowledge gained. Interpreting time from growth layers is similar to tree-ring interpretation. Other topics discussed are: taking a census, measuring the past, and fossil clocks. — ESL

00220 **Behrens, E. W.; Frishman, S. A.** Stable carbon isotopes in blue-green algal mats: Jour. Geology, v. 79, no. 1, p. 94-100, illus., 1971.

Nine sets of blue-green algal mats have accumulated in the upper 60 cm of sediment during the last 1,000 years in a small lagoon on the margin of Baffin Bay, southeast Texas. The amount of organic carbon in the upper six mats decreases with depth (4.4 to 2.7 percent), and δC-13 increases (-16.7 to -14.4 per mil, PDB). Organic carbon in the mats is isotopically heavier than the carbon of the associated bay sediments, and this difference is apparently increased by anaerobic bacterial fractionation. If stromatolitic structures in ancient rocks were formed in association with blue-green algae, the organic carbon should be enriched in the heavier C-13 by 2 to 5 per mil over the organic carbon in the enclosing marine sediment. — VES

07344 **Belt, Edward Scudder.** Stratigraphy and sedimentology of the Mabou Group (Middle Carboniferous), Nova Scotia, Canada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2058B, 1970.

07566 **Belz, David J.** Allegheny County soils, *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 93-103, illus., tables, 1970.

Residual, colluvial and alluvial soils of Allegheny County are described in text and tables. — EH

00324 **Bennett, G.; Innes, D. G.** Strathy Township, District of Nipissing: Ontario Dept. Mines and Northern Affairs Prelim. Map P.667, (Geol. Ser.), scale 1 in. to 1/4 mi., text, 1971.

Geology of the township is characterized by a wide variety of Precambrian rock types, as well as local zones of shearing, carbonatization, and silicification. The Tetapaga Lake syncline is a major structure, and many lineaments are not on airphotos. Gold, molybdenum, sulfide, and iron prospects are described. — ESL

07178 **Benson, D. G.** Notes to accompany geological maps of Antigonish and Cape George map-areas, Nova Scotia (11 F/13 W/12, 11 F/12): Canada Geol. Survey Paper 70-8, 2 p., geol. maps, 1970.

Canada Geol. Survey Prelim. Ser. Map 2-1970 (Antigonish, east half) and 3-1970 (Antigonish and Cape George, west halves) are in pocket. Formations range from the Ordovician and earlier Browns Mountain Group to the upper Carboniferous Port Hood Formation. The Browns Mountain Group was strongly folded and faulted during at least two periods of deformation. Minerals located include salt, gypsum, anhydrite, and minor amounts of sulfides. — MCM

07179 **Benson, D. G.** Notes to accompany maps of the geology of Merigomish and Malignant Cove map-areas, Nova Scotia (11 E/16 E1/2, 11 E/9): Canada Geol. Survey Paper 70-9, 5 p., geol. maps, 1970.

The west half of Merigomish map-area is shown on Canada Geol. Survey Prelim. Ser. Map 5-1970; the east halves of Merigomish and Malignant Cove area on Map 4-1970 (in pocket). Formations range from Ordovician and earlier rhyolite to the upper Carboniferous Pictou Group. Most of the lowland area is covered by glacial deposits; valleys in the Antigonish Highlands have been modified by glaciers. The Highlands have undergone at least three periods of deformation, two of which affected the Silurian rocks. There is some mineralization in the area, two good gypsum exposures, and numerous gravel deposits. — MCM

07582 **Bentley, Robert Donald.** Geologic evolution of the Beartooth Mountains, Montana and Wyoming, Pt. 9 — Cloverleaf Lakes area [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1349B, 1970.

07321 **Berg, Robert R.** Identification of sedimentary environments in reservoir sandstones, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 137-143, illus., 1970.

Interpretation of depositional environment for reservoir sandstones requires knowledge of primary rock properties, each of which has its special significance.

Compositional and textural changes in vertical sequences are the most important criteria, but because they are interdependent composition alone may be a key indicator of environment. The use of compositional criteria is illustrated by the lower Cretaceous Muddy sandstones of the Powder River basin. Sedimentary structures are also significant. Morphology of sandstone bodies commonly suggests depositional environment, but is not as reliable unless other rock properties are known. Interpretation of morphology is often the main exploration problem in the case of stratigraphic traps. Secondary properties — porosity and permeability — may reflect compositional and textural changes because they are largely dependent on the primary properties. — DBV

07334 **Berg, Robert R.** Method for determining permeability from reservoir rock properties, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 303-317, illus., table, 1970.

Porosity and permeability of reservoir sandstones can be related to primary rock properties of composition, texture, and packing. Permeability is assumed to be largely a function of rectilinear pore size which is a function of mean grain size, sorting as expressed by deviation of grain size distribution, mean grain shape, and packing of grains. By systematic packings of uniform spherical grains, size and shape of rectilinear pores can be determined for porosities of 30-40 percent. By considering laminar flows of fluids through pores of idealized cross sections, a general equation can be derived. When the equation is applied to clean sands and sandstones of 30-40 percent porosity, permeability may be calculated with reasonable accuracy. Agreement between theoretical and measured values suggests this approach may be applicable to other packings and porosities in subsurface reservoir sandstones. — *from* Author's abstract

07364 **Berger, Jonathan.** A laser earth strain meter [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2068B, 1970.

07216 **Berryhill, Henry L., Jr.; Schweinfurth, Stanley P.; Kent, Bion H.** Coal-bearing Upper Pennsylvanian and Lower Permian rocks, Washington area, Pennsylvania: U.S. Geol. Survey Prof. Paper 621, 47 p., illus., tables, geol. maps, 1970.

The Washington area comprises the Washington West, Washington East, Amity, and Prosperity 7 1/2-minute quadrangles in southwestern Pennsylvania. Gently folded bedrock exposed consists of crudely cyclic, repetitive sequences of sandstone, siltstone, mudstone, claystone, limestone, and coal; lithologic maps portray facies changes in surface exposures, and lithofacies maps portray facies changes in surface exposures, and lithofacies maps portray subsurface changes. Of the 17 coal beds exposed, only the Pittsburgh is mined commercially; however, the Waynesburg also contains sizable resources and, as of January 1966, remaining resources of coal in these two beds in the Washington area total nearly 1.5 billion tons. Sandstone and limestone are used in road construction; mudstone is used for making brick; and some mudstone units are potential sources of lightweight aggregate. — BHK

Bianchi, W. C. *See* Nightingale, H. I. 07220

07331 **Biel, Ralph.** Observations on the composition of some Miocene and recent planktonic foraminiferal assemblages, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 275-279, illus., 1970.

The composition of planktonic foraminiferal assemblages changes with depth in the present day oceans. The dominant qualitative variable accompanying water depth changes appears to be water temperature. This is a function of either bathymetry or geographical latitude. Therefore, within areas of corresponding latitudes, bathymetry seems the most pertinent factor for distinct compositional patterns of planktonic foraminifers. It is suggested that these concepts are valid and applicable in interpreting paleobathymetries of marine sediments at least as old as the lower Miocene. Empirical data are presented showing compositional changes for early Miocene planktonic foraminiferal assemblages in the South Louisiana subsurface. These are comparable to compositional changes in today's oceans. — Author's abstract

Bing, Donald E. *See* Wilson, Edward C. 07614

07640 **Birch, Francis S.** The Barracuda fault zone in the western North Atlantic — Geological and geophysical studies: Deep-Sea Research, v. 17, no. 5, p. 847-859, illus., table, 1970.

In the Barracuda Fault Zone between 15°-18° N. and 56°-59° W., the main bathymetric feature is the E-W Barracuda Ridge bounded on the north by Barracuda Abyssal Plain and on the south by Demerara Abyssal Plain. Sediments are *Globigerina* ooze above depths of 5000 m and brown lutite below, except on abyssal plains which are of interlayered lutites and turbidites. Sediment thickness exceeds 3500 m under the abyssal plain and 2500 m south of the ridge; elsewhere it is only a few hundred meters. Crustal layers are about 7 km thick with top of crust and mantle about 3 km shallower under the ridge than elsewhere. Gravity anomalies correlate well with bathymetry or basement relief and are accounted for by density differences in the upper 15 km below sea level. Magnetic anomalies show N-W lineations north of the ridge. Heat flow is 1.25×10^{-6} cal/cm^2 sec. The Barracuda Ridge probably formed by normal faulting. — *from* Author's abstract

00226 **Bishop, William F.** Geology of a Smackover stratigraphic trap: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 51-63, illus., table, 1971.

In the Lick Creek field, Claiborne Parish, Louisiana, oil is produced from a calcarenite bar at the top of the Late Jurassic Smackover Formation. Production is limited updip by an absence of porosity. On the Smackover shelf slope, calcarenite was deposited on turbulent shoals localized by contemporaneous structural movement. Isopach maps of rock units in the upper Smackover show stratigraphic closure; a structural irregularity presumably initiated deposition of these units. The reservoir facies is mainly oolites with sparry calcite cement and primary intergranular porosity; it grades into the overlying Buckner mudstone. Below the reservoir is a thick terrigenous unit of mostly calcareous sandstone. Underlying this sandstone is a partly dolomitized pellet-mud facies and zones of microcrystalline dolomite and disturbed mudstone. Below the pellet-mud is a mixed facies. Smackover allochems are almost entirely nonskeletal. — *from* Author's abstract

07301 **Black, David Charles.** Trapped helium, neon, and argon in meteorites — Boundary conditions on the formation and evolution of the solar system [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2439B, 1970.

07513 **Blackburn, G.; Taylor, R. M.** Limestones and red soils of Bermuda — Reply [to 1970 discussion by O. P. Bricker and F. T. Mackenzie of 1969 paper]: Geol. Soc. America Bull., v. 81, no. 8, p. 2525-2526, 1970.

The original paper was published in ibid., v. 80, no. 8, p. 1595-1597, 1969.

07453 **Blake, Wilson; Leighton, Fred.** Recent developments and applications of the microseismic method in deep mines, Chap. 23 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 429-443, illus., 1970.

Basic research findings and application of new microseismic equipment and techniques to study of ground control problems in deep mines are discussed. Broadband seismic monitoring is discussed and its application in several mines in the Coeur d'Alene mining district near Wallace, Idaho is described. It is concluded that broadband microseismic monitoring provides much more quantitative information about rock behavior than does traditional microseismic monitoring; when used by experienced personnel, it can detect, delineate, and estimate stability of potential failure zones in rock structures. In deep mines, location of zones of inferred high stress can be pinpointed. — VSN

Blakely, Robert F. *See* Carr, Donald D. 07529

07608 **Bloxham, W. M.; Siple, George E.; Cummings, T. Ray.** Water resources of Spartanburg County, South Carolina: South Carolina Water Resources Comm. Rept. 3, 112 p., illus., tables, 1970.

As a source of supply, streams of Spartanburg County afford many times the quantity of excellent-quality water presently required. Wells drilled in the characteristic granitic biotitic, and hornblendic rocks of the Inner Piedmont Belt yield from 1 to 250 gmp; highest average yield (35 gpm) of inventoried wells was from those drilled in biotite gneiss and migmatite. Average yield of all wells for which data were available was 20 gpm; average for those to obtain their maximum development was 53 gpm; and average yield for highest 3 percent was 139 gpm. Quality is good to excellent for most domestic, municipal, and industrial use. — *from* Authors' abstract

07559 **Bolles, William H.; Lapham, Davis M.** Quartz roses for your rock garden: Pennsylvania Geology, v. 1, no. 8, p. 11-12, illus., 1970.

An unusual form of quartz with a rosette structure has been found in the Mechanicsburg area. It occurs at the top of the Rockdale Run Formation, a fine-grained, mechanical limestone with dolomite laminae. Where they are well developed, the quartz has a banded concentric structure. Quartz in bands is milky, and grains are microscopic in size. It is believed that they are not replacements of algal colonies. Slices reveal that the inside of a group contains rounded clear quartz grains in a matrix of hematite and limonite between rosettes, suggesting that the quartz grew after or during oxidation or weathering. The colloform structure of the rosettes suggests growth from a colloidal silica gel. — ESL

07425 **Bollin, E. M.** Chalcogenides, Chap. 7 *in* Differential thermal analysis — V. 1, Fundamental aspects (R. C. Mackenzie, editor): London and New York, Academic Press, p. 193-236, illus., 1970.

Chalcogenides include sulfides, selenides, tellurides, and, by association, arsenides and antimonides. Earlier DTA studies, carried out in static air atmospheres, are reviewed briefly. In recent advances, sample-environment relations must be rigidly controlled. Topics discussed include: sample configuration, types of thermocouple, and atmosphere control. Five categories of reaction are proposed; other complexities of oxidative reactions discussed include: effect of restricted gas exchange, sample dilution, vapor-phase dissociation, and high-resolution. Vapor-pressure studies include: effect of pressure, techniques of measurement, evacuated-vial techniques, and system Ag-S as a sealed-vial study. The fine structure of peaks representing phase transitions is described for chalcocite and pyrrhotine. It is concluded that DTA can now be applied in phase studies. An appendix covers fabrication and handling of sealed silica vials. — ESL

07345 **Bond, Gerard Clark.** Permian volcanics, volcaniclastics, and limestones in the Cordilleran eugeosyncline, east central Alaska Range, Alaska [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2058B-2059B, 1970.

07191 **Bonine, Michael E.; Holz, Robert K.; Gill, Clark C.; Weiler, James P.; Arbingast, Stanley A.** Atlas of Mexico: Austin, Tex., Univ. Texas Austin, Bur. Business Research, 138 p., illus., tables, 1970.

In the first section on physical setting of Mexico, maps of geological interest are those on: physiography, landforms, topography, tectonics, surface geology, and river and drainage basins. The bulk of the atlas is devoted to population, agriculture, transportation, services, commerce, and industry. — MCM

Bonnet, C. W. *See* Gabrysch, R. K. 07205

07346 **Bonnett, Richard Brian.** Glacial sequence of the upper Boulder Creek drainage basin in the Colorado Front Range [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2059B, 1970.

Boreman, Judith A. *See* Chao, E. C. T. 07547

07365 **Boucher, Gary Wynn.** Three studies of microearthquakes — [Pt.] 1, The microearthquake seismicity of the Denali fault; [Pt.] 2, Microearthquake investigations in Nevada; [Pt.] 3, Earthquakes associated with underground nuclear explosions [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2068B-2069B, 1970.

07530 **Bourne, H. L.** The challenge for the geologist in the extractive industry, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 138-141, 1970.

The geologist in the extractive industry is a combination of exploration, economic and environmental geologist. Since most well-known economic deposits have already been, or are being, exploited by the extraction industry, the exploration geologist must accumulate old and new information and interpret it in terms of today's needs and technology. The economic geologist has to be competent in technical areas and also in areas of finance, real estate, and law. The environmental geologist has a responsibility to affect multiple land use concepts and to improve the image of the industry. Goals can be achieved by instituting good neighbor practices and educating local citizens and planners. Industrial geologists are challenged to accumulate information, and to apply it as an explorationist, economist, and an environmentalist; educators to initiate curriculum changes to include business courses for geology majors; and state survey geologists to tabulate lists of geological theses and university publications. — *from* Author's abstract

07407 **Bourne, Harold L.** A new sand and gravel deposit — From perception to production [abs.]: Mining Eng., v. 22, no. 9, p. 52-53, 1970.

07188 **Bowen, R. G.; Peterson, N. V.** (Compilers). Thermal springs and wells in Oregon: Oregon Dept. Geology and Mineral Industries Msc. Paper 14, 1 sheet, scale about 1 in. to 16 mi., 1970.

Information tabulated by county on the back of the map includes: number on map, name of spring or well, location, temperature, reference number (to listed references), and notes. — MCM

Boyd, C. C. *See* Hasan, S. M. 07656

00326 **Boyer, Robert E.** Field guide to rock weathering — Earth Sci. Curriculum Proj. Pamph. Ser. PS-1: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 36 p., illus., 1971.

Aspects of weathering described include physical, chemical, and rate. Preparation for a field trip to an outcrop and things to look for in examining a rock (color, hardness, mineral hardness, rock fabric, reaction to dilute hydrochloric acid, joints, rock debris, and soil profiles) are described. Weathering characteristics of sedimentary, igneous, and metamorphic rocks are discussed. Things to be included in sketching an outcrop are listed, and suggestions are given for sampling for laboratory study. Brick buildings and tombstones are also suggested for weathering studies. Nine questions are given to answer after the field trip. — ESL

00203 **Bradbury, J. P.** Limnology of Zuni Salt Lake, New Mexico: Geol. Soc. America Bull., v. 82, no. 2, p. 379-398, illus., table, 1971.

Zuni Salt Lake, a source of salt for Zuni Indians for centuries, occupies part of a maar formed in Pleistocene time by phreatic explosions. Of three cinder cones in the maar, one contains a pool with water surface slightly higher than that of the main lake. Both water bodies are saline, but fluctuate in size and salinity seasonally and from year to year. The lake goes completely dry some years. Water is introduced by surface inflow, springs (some saline), and seeps. Source of the salines, principally NaCl, is by inference halite and gypsum beds of Supai Formation at depth. Lake sediments consist of halite, calcite, and gypsum interbedded with clay and organic matter. Dominant organisms are brine shrimp, shore flies, and algae; purple bacteria are common in the pool. — JHF

Bradley, Reta E. *See* Dutton, Carl E. 07499

07447 **Brady, B. T.** Effect of the intermediate principal stress on the fracture of brittle rock, Chap. 16 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 267-279, illus., 1970.

The formulation of analytical methods for design and determination of stability of engineering structures in competent brittle rock materials is considered. Such structures include excavated subsurface openings, open surface structures, or a system of openings in rock that is virtually self-supporting. Knowledge of the mechanical properties of the material is essential, and because of physical limitations of equipment and cost of in-situ measurements, most testing is on small-scale laboratory measurements. A partial analysis is developed here describing mechanical behavior of rock under multiaxial stress conditions, i.e., analyzing and assessing the effect of intermediate principal stress on brittle rock behavior. It is concluded that this effect is not large enough to warrant consideration in engineering calculations on brittle rock under multiaxial stress conditions. — VSN

Braidech, Lawrence L. *See* Herdendorf, Charles E. 07527

Bramlette, M. N. *See* Bukry, David. 07149

07200 **Braun, Robert L.; Ramspott, Lawrence D.** Quantitative phase analysis of rocks by X-ray diffractometry: California Univ. Livermore, Lawrence Radiation Lab., [Rept.] UCRL-50921, 19 p., illus., tables, 1970.

With this method for modal analysis of quartz, calcite, and dolomite, indicated precision for a single measurement at 95 percent confidence level is approximately 8 percent of the amount present for quartz and 20 percent for calcite and dolomite. Higher precision can be obtained, as indicated in analysis of a synthetic rock with five replicate analyses. During analyses of 156 samples of alluvium and tuff, detectability limits of 0.5 wt percent calcite and 1 wt percent dolomite were obtained. Precision is much improved with a rotating sample holder, repeatedly mounting and analyzing a given sample until desired precision is attained. The most troublesome systematic errors, caused by peak superposition or by difference in degree of crystallinity, can be largely overcome by basing analysis on maximum rather than integrated intensity, with a correction factor empirically related to halfwidth of the diffraction line. — *from* Authors' abstract

Bray, Ellis E. *See* Nelson, Henry F. 07662

07462 **Bretsky, Peter William, Jr.** Upper Ordovician ecology of the central Appalachians [with German and Russian abs.]: Yale Univ. Peabody Mus. Nat. History Bull. 34, 150 p., illus., tables, 1970.

The upper Reedsville-Martinsburg strata, along a 600-mi Ordovician shoreline from east-central Pennsylvania to northern Tennessee, provide the earliest known clastic-facies marine faunas of modern aspect. Distribution of the 31 most common species or genera in the numerically dominant groups — trepostome bryozoans, brachiopods, gastropods, pelecypods — outlines 12 faunal provinces, from which autecology is interpreted. Three communities based on zoogeography and autecology are subdivided into seven populations: *Sowerbyella-Onniella* community (strophomenid and orthid-crinoid populations), muddy silt of outer sublittoral; *Orthorhynchula-Ambonychia* (linguloid, rhynchonellid, and modiolopsid), sand-silt of inner sublittoral and intertidal; *Zygospira-Hebertella* (spiriferid and orthid), mud and silty mud of inner and outer sublittoral. The longshore faunal distribution pattern is distinctive, as well as the onshore to offshore. — VMJ

07512 **Bricker, O. P.; Mackenzie, F. T.** Limestones and red soils of Bermuda — Discussion [of paper by G. Blackburn and R. M. Taylor, 1969]: Geol. Soc. America Bull., v. 81, no. 8, p. 2523-2524, 1970.

The original paper was published in ibid., v. 80, no. 8, p. 1595-1597, 1969.

07472 **Bridgwater, D.; Coe, K.** The role of stoping in the emplacement of the giant dykes of Isortoq, South Greenland, *in* Mechanism of igneous intrusion (Geoffrey Newall and Nicholas Rast, editors) — Liverpool Geol. Soc. Symposium, Liverpool, England, 1969, Proc.: Geol. Jour., Spec. Issue no. 2, p. 67-78, illus., 1970.

Four giant syeno-gabbro dikes of Mid- or Late-Gardar age are described which postdate all other members of the northeast-trending dike swarm in the Isortoq area. They are typically pod-shaped bodies with elongate-elliptical horizontal sections. Evidence for a nondilatational emplacement is particularly apparent where bridges occur between separate dike units. In all cases the host rock shows no deformation due to emplacement and no structural features different from the regional features or attributable to emplacement of igneous material. It is concluded that the Isortoq bodies were intruded under kratogenic conditions, linear development was controlled by pre-existing structure, stoping was the major factor in emplacement, intruded magma differentiated in the dike fissure was followed by further movement of magma in some cases, and stoped material sank in magma of relatively low density and viscosity. — VSN

07524 **Briggs, Louis I.** Geology of gypsum in the Lower Peninsula, Michigan, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 66-76, illus., 1970.

Gypsum has been produced in Michigan since 1841, and production for the last 40 years has ranged second in the U.S. All production comes from the Mississippian Michigan Formation, by open-pit strip mining near Alabaster, adjacent to Lake Huron immediately north of Saginaw Bay, and by shallow mines near Grand Rapids. Extensive thick gypsum occurs elsewhere within both the Michigan Formation and the Detroit River Group. In most areas gypsum occurs under overburden of glacial drift and bedrock of 500-2500 feet, making exploitation economically less favorable than present areas of mining under current supply and market conditions. Transportation costs are also generally less favorable in unexploited areas, but future market demands should make these deposits economically attractive to warrant detailed exploratory evaluation. — *from* Author's abstract

Brindley, G. W. *See* Hang, Pham Thi. 07617

00289 **Brodkorb, Pierce.** The paleospecies of woodpeckers: Florida Acad. Sci. Quart. Jour., v. 33, no. 2, p. 132-136, illus., 1970 [1971].

Fossil history of woodpeckers, family Picidae, has been alleged to extend back to the Eocene in North America and the Miocene in Europe, but it now appears that all such records should be referred to other families in the order Piciformes, or even to different orders. Valid extinct species of woodpeckers are known only from the Pliocene and Pleistocene of North America; they include *Pliopicus brodkorbi* and *Palaeonerpis shorti* from the lower Pliocene of Kansas and Nebraska, respectively, and *Bathoceleus hypalus* from the upper Pleistocene of the Bahamas. Also, 28 extant species are recorded from Pleistocene deposits in the Holarctic and Neotropical regions. A new Neotropical paleospecies, *Campephilus dalquesti*, is described from an upper Pliocene, early Blancan fauna in Surry County, Texas; it is compared with extant species of *Campephilus* and *Dryocopus*. — VMJ

07239 **Brodkorb, Pierce.** An Eocene puffbird from Wyoming: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 13-15, illus., tables, 1970.

A new genus and species of Bucconidae, *Primobucco mcgrewi*, is described from Lincoln County, Wyoming, in Lower Eocene beds of the Green River Formation (late Wasatchian age). The type specimen is a wing. This fossil provides the earliest record of the family, and of the order Piciformes, of which the puffbirds are the structurally most primitive group. Today the Bucconidae are restricted to the American tropics. Another fossil bird, *Uintornis lucaris* Marsh, was described from a tarsometatarsus from the Middle Eocene in the upper part of the Bridger Formation at Henry's Fork, Wyoming. It has been considered as of uncertain systematic position, but is here referred to the Bucconidae. It is a larger bird than the Green River species. — Author's abstract

00292 **Broecker, Wallace S.; Oversby, Virginia M.** Chemical equilibria in the Earth: New York, McGraw-Hill Book Co., 318 p., illus., tables, 1971.

This textbook for undergraduate science majors applies thermodynamic and kinetic arguments to chemical systems in earth sciences. The first five chapters (thermodynamics as a geologic tool, volume, energy, randomness and entropy, equilibrium and its attainment) provide an introduction to thermodynamic logic from macroscopic and atomic points of view. The remaining seven chapters (reactions in natural gases, distribution of trace isotopes between coexisting phases, distribution of trace elements between coexisting phases, solid-state mineral transformations, melting phenomena, solid-solution phenomena, reactions in natural waters) deal with the most common types of chemical reactions encountered in earth science and contain at least one common process taking place within the solar system. — MCM

00259 **Brookfield, M.** Location of ancient mid-oceanic rises: Nature Phys. Sci., v. 229, no. 7, p. 204-205, 1971.

Positions of pre-Mesozoic mid-oceanic rises may be inferred from structures produced in any overlying continental area. The hypothetical sequence of events for continental areas above developing rises is: (1) uplift and rifting, with andesite and basalt eruptions; (2) separation of crustal blocks, flooding of the rift by the sea, vast eruptions of basalt, intrusion of basalt dikes, transcurrent faulting, intrusion of alkaline magmas; (3) further separation, subsidence of new continental margins, and deposition of thick sediments. Worldwide marine transgressions should correspond with developing mid-oceanic rises. Many features associated with continental splitting, now hidden beneath continental shelves, are preserved in relatively stable marginal zones; ancient rises can be postulated from marginal rifts when the main crest is submerged or destroyed by rewelding of continents. Rises tend to develop in areas previously orogenic. — DBV

Broughton, W. A. *See* Heyl, A. V. 07202

Brown, Karen E. *See* Davis, Darrell E. 07335

00232 **Brown, Robert D., Jr.** Evidence for thrust faulting in northern Olympic Peninsula, Washington — Discussion (of paper by Robert G. McWilliams, 1970): Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 126-129, 1971.

For the paper under discussion, *see* ibid., v. 54, no. 2, p. 344-349, 1970; Abs. North American Geology, August 1970.

00245 **Browne, Ruth G.** Misassignment of Silurian gastropod protoconch casts to taxa of Foraminifera: Jour. Paleontology, v. 45, no. 1, p. 141, 1971.

Several forms described by Browne and Schott (1963) as arenaceous Foraminifera from the Silurian Osgood Formation of Indiana are recognized as gastropod protoconch casts. — RCD

Bruhn, R. W. *See* Einstein, H. H. 07439

Brune, James N. *See* Davies, Geoffrey F. 00257

00296 **Brzezinski, L. S.** A review of the 1924 Kenogami landslide [with French abs.]: Canadian Geotech. Jour., v. 8, no. 1, p. 1-6, illus., 1971.

A major landslide of the flow variety took place in the fall of 1924 in the Lake St. John region of the Province of Quebec, Canada. The slide involved 2.5 million cubic yards (2.0×10^6 m^3) of clay and resulted in loss of life and considerable damage to property. A review of the circumstances preceding failure, the geotechnical properties of the clay and the mechanism of the slide movements is presented in the paper. — Author's abstract

07502 **Bugel'skiy, Yu. Yu.; Formel'-Kortina, F.** Nekotoryye osobennosti gidrogeokhimii nikelenosnykh kor vyvetrivaniya [Hydrogeochemical characteristics of Cuban

nickeliferous weathering profiles]: Kora Vyvetrivaniya 1970, no. 11, p. 246-257, illus., 1970.

Nickeliferous weathering profiles are described from the Upper Cretaceous ultrabasic rocks (harzburgites) of Cuba. Structural tectonics and erosional accumulation factors are related to the geomorphologic features. Concentration of Ni silicates is maximum in the serpentinized peridotites. Hydrogeologic studies of the ground water in the weathered zone indicates an increase of HCO_3 content with SiO_2 (mg/l). Disintegrated serpentinites show a decrease in the hydrocarbonate ions with SiO_2 and MgO.

07149 **Bukry, David; Bramlette, M. N.** Coccolith age determinations Leg 5, Deep Sea Drilling Project, Chap. 18 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 487-494, illus., tables, 1970.

This report combines results of study of 168 coccolith samples from 131 cores recovered during Leg 5 of the Project. Light-microscope techniques were used to identify assemblages. Following a brief summary of cocolith stratigraphy at each site, some age-diagnostic species in selected samples from each site are listed. Samples in which no calcareous nannoplankton were found are also listed. — ESL

07643 **Bukry, David.** Coccolith age determinations Leg 4, Deep Sea Drilling Project, Chap. 17 *in* Initial reports of the Deep Sea Drilling Project — V. 4, Leg 4 of cruises of *Glomar Challenger*, Rio de Janeiro, Brazil, to San Cristobal, Panama, Feb.-Mar. 1969 (R. G. Bader, and others): Washington, D. C., U.S. Govt. Printing Office, p. 375-381, illus., 1970.

A total of 173 samples from the 120 cores recovered on Leg 4, off the Brazilian coast and in the Caribbean, were examined by light microscope techniques for coccolith assemblages; species considered in this report are listed. A brief summary of the coccolith stratigraphy for each site is followed by the age-diagnostic species in selected samples from the site. — ESL

00287 **Burdick, D. W.; Strimple, H. L.** Intercontinental occurrence of *Ophiurocrinus hebdenensis* Wright, a Carboniferous crinoid: Oklahoma Geology Notes, v. 31, no. 1, p. 13-17, illus., 1971.

Ophiurocrinus hebdenensis Wright, 1950, previously known only from British Carboniferous strata, is reported from the lower Fayetteville Formation, just southwest of Fayetteville, Ark. This occurrence represents the first crinoid species reported from the type area of the Fayetteville, and only the second species common to Upper Mississippian strata in the United States and equivalent strata outside North America. — *from* Authors' abstract

07555 **Burdick, D. W.; Strimple, H. L.** The occurrence of *Pterotocrinus* in Oklahoma: Oklahoma Geology Notes, v. 30, no. 5, p. 121-123, illus., 1970.

The crinoid genus *Pterotocrinus* Lyon and Casseday evolved rapidly and allows correlation within its small geographic range, and has been used for correlation in the Eastern Interior. It is known only from Late Mississippian rocks in the United States. Crowns are rare, but wingplates are abundant, and several lineages are recognized. The authors question identification of materials previously ascribed to this genus from strata west of the Mississippi River, but report here its occurrence in two localities in the upper Fayetteville of Oklahoma. — ESL

Burns, Robert E. *See* McManus, Dean A. 07143

07157 **Burns, Robert E.** Heat-flow operations at holes 35.0 and 35.1, Chap. 28 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 551-554, illus., tables, 1970.

Several attempts were made to measure the temperature gradient in holes at Site 35 of Leg 5, but the record was marred by high-temperature jumps indicating damage to the probe. Bad weather prevented further attempts. Records for each lowering have been passed through a filter suppressing the effect of the high-temperature spikes, and the results are considerably less ambiguous. An estimate of heat flow based on these data shows a temperature gradient of 0.27×10^{-3}°C cm^{-1}, quite low. Estimated heat flow based on thermal conductivities is 1.3×10^{-6} cal/cm^2 sec. — ESL

Burns, Robert E. *See* McManus, Dean A. 07249

07347 **Butler, Godfrey Philip.** Holocene supratidal evaporites — An analogue of ancient evaporites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2059B-2060B, 1970.

07406 **Buttgereit, Charles D.; Wrathall, Don M.** A digital processing system for aeromagnetic maps [abs.]: Mining Eng., v. 22, no. 9, p. 52, 1970.

07389 **Caldwell, A. Blake.** Twin Buttes — Anaconda's concept for mining and processing a low-grade copper ore: Mining Eng., v. 22, no. 4, p. 51-66, illus., 1970.

This comprehensive article discusses the history, geology, mining and metallurgical technology of the Twin Buttes copper deposit in southern Arizona. The deposit contains oxide and sulfide copper minerals which are disseminated and filling fractures in disturbed and altered Paleozoic limestones and clastic rocks, Mesozoic clastic rocks, and an associated quartz monzonite porphyry. Much of the deposit is buried under 0-600 feet of post-mineralization alluvium. Secondary enrichment has occurred but is highly erratic. — MAC

07523 **Callender, Edward.** The economic potential of ferromanganese nodules in the Great Lakes, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 56-65, illus., tables, 1970.

Ferromanganese nodules occur in all the Great Lakes with the greatest deposits in northern Lake Michigan, where nodules average 20 percent Fe and 8 percent Mn; trace element content is one to two orders of magnitude lower than marine material. Lake Michigan nodules contain unusually high concentrations of barium and arsenic which appear associated with hydrous manganese oxide. Reconnaissance sampling of the Upper Great Lakes revealed nodules at many localities exhibiting a similar geologic environment; nodules always occur in oxidized sands that overlay stiff red and gray lacustrine clays, are extremely sensitive to oxidation-reduction potential, and seldom occur in mildly oxidizing sediments. Sedimentation rates are an important factor in preservation of ferromanganese nodules. Synthesis of geologic and geochemical data permits evaluation of parameters that may be useful in exploration for ferromanganese deposits in the Great Lakes. — *from* Author's abstract

07642 **Cameron, Christopher P.; Stone, David B.** Paleomagnetic data from the margin of a hypabyssal andesite in the western Aleutians, Alaska: Earth and Planetary Sci. Letters, v. 9, no. 5, p. 388-390, illus., table, 1970.

Paleomagnetic data used to establish the thermal nature of an andesite-sediment contact on Shemya Island are reported. The variations in the magnetic properties of the andesite appear to result from systematic increases in oxidation effects toward the contact. — Authors' abstract

07366 **Campbell, David Lowell.** The loading problem for a viscoelastic earth [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2069B, 1970.

07163 **Campbell, G. E.** Southeast portion of East area, Strand oil field: California Oil Fields — Summ. Operations 1970, v. 56, no. 1. p. 25-32, illus., tables, 1970.

The Strand field is near the western end of the Bakersfield arch; production in the southeast portion of the East area is from an anticlinal fold. The single producing zone is the top 30 to 40 feet of the lower Stevens (upper Miocene) "73-2" sand. As of December 1969, cumulative production was 480,570 bbl oil. — MCM

07113 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 C/2, Newfoundland: Canada Geol. Survey Geophysics Paper 5921, scale 1:63,360, 1970.

07114 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 C/7, Newfoundland: Canada Geol. Survey Geophysics Paper 5943, scale 1:63,360, 1970.

07115 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 C/10, Newfoundland: Canada Geol. Survey Geophysics Paper 5972, scale 1:63,360, 1970.

07116 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 C/15, Newfoundland: Canada Geol. Survey Geophysics Paper 5993, scale 1:63,360, 1970.

07117 **Canada Geological Survey.** Aeromagnetic series, McKenzie River, Newfoundland: Canada Geol. Survey Geophysics Paper 6022, scale 1:63,360, 1970.

07118 **Canada Geological Survey.** Aeromagnetic series, Goose River, Newfoundland: Canada Geol. Survey Geophysics Paper 6043, scale 1:63,360, 1970.

07119 **Canada Geological Survey.** Aeromagnetic series, Cape Caribou River, Newfoundland: Canada Geol. Survey Geophysics Paper 6072, scale 1:63,360, 1970.

07120 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 F/15, Newfoundland: Canada Geol. Survey Geophysics Paper 6092, scale 1:63,360, 1970.

07121 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 K/2, Newfoundland: Canada Geol. Survey Geophysics Paper 6121, scale 1:63,360, 1970.

07122 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 K/7, Newfoundland: Canada Geol. Survey Geophysics Paper 6137, scale 1:63,360, 1970.

07123 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 K/10, Newfoundland: Canada Geol. Survey Geophysics Paper 6166, scale 1:63,360, 1970.

07124 **Canada Geological Survey.** Aeromagnetic series, Sheet 13 K/15, Newfoundland: Canada Geol. Survey Geophysics Paper 6181, scale 1:63,360, 1970.

07420 **Cannon, Helen L.** Trace element excesses and deficiencies in some geochemical provinces of the United States, *in* Trace substances in environmental health III — Conf. on Trace Substances in Environmental Health, 3d Ann., Columbia, Mo., 1969, Proc.: Columbia, Mo., Univ. Missouri, p. 21-43, illus., tables, 1970.

Concentrations of metals in soils and rocks and their availability to plants and animals vary widely among geochemical provinces. Glaciated areas are characterized by poorly developed soils and interrupted drainage, resulting in peat bogs, which may be deficient in Mn, Cu, Mo, I, and Co, but may contain anomalous Zn, Pb, and Cd where they overlie mineralized limestones. Limestone soils are rich in P and K, serpentine soils in Cr and Ni, some shales in Se, and phosphate rock in U and V. Coastal plain sands are deficient in Fe, B, Mn, Cu, and Se. Evaporative salts of B, Mg, F, Li, and K occur in western closed basins and are accumulated by plants. Accessory metals as well as major metals are abundant in soils and plants of mining districts. The distribution of Pb, As, Cd, Hg, Se, and Te may be particularly important in regard to health. — *from* Author's abstract

00325 **Card, K. D.** (compiler). Panache Lake area (west and east parts): Ontario Dept. Mines and Northern Affairs Prelim. Maps P.668, 669 (Geol. Ser.), scale 1 in. to 1 mi., 1971.

07199 **Cardwell, Dudley H.; Patchen, Douglas G.; Woodfork, Larry D.** (and others). Oil and gas fields of West Virginia, showing gas storage fields, pipelines, gasoline plants, propane plants, compressor stations, refineries, structural axes, depths to producing zones, and important wildcat wells: Morgantown, W.Va., West Virginia Geol. Survey, scale 1:250,000, separate text, 1970.

The text contains general comments on the producing fields, sketch maps showing new areas of oil and gas production and production development in the stratigraphic sequences, and drilling and production information for fields shown on the map. — MCM

00266 **Carlson, Charles G.** Lucian Hickman Walker (1894-1970): Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 135-136, portrait, 1971.

Carlson, Richard C. *See* Hearst, Joseph R. 07218

07196 **Carlson, V. A.** Bedrock topography of the Medicine Hat map-area, NTS 72L, Alberta, west of fourth meridian: Edmonton, Alberta, Research Council Alberta, scale 1:250,000, 1970.

Inset maps show drift thickness, thalwegs, and data density.

Carothers, James E. *See* Porter, Christopher R. 00276

07529 **Carr, Donald D.; French, Robert R.; Blakely, Robert F.** Relationships between physical and chemical properties of the Brassfield Limestone (Silurian) in Indiana, Ohio, and Kentucky, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 127-137, illus., tables, 1970.

Statistical correlation of nine physical and 10 chemical properties of 17 samples of the Brassfield Limestone in Indiana, Ohio, and Kentucky found negative correlations between: absorption and specific gravity, soundness loss and $CaCO_3$ content, and abrasion loss and sulfur content. Positive correlations were found between: P_2O_5 content and soundness loss, absorption and soundness loss, and absorption and compressive strength. Correlations were directed to primary properties used by the Indiana Highway Commission to grade quality of limestone aggregate. In exploration for quarry sites in the Brassfield Limestone primary consideration should be given to limestones with a high $CaCO_3$ content; however, limestones that contain small amounts of disseminated impurities in the form of pyrite and quartz silt may have more resistance to abrasion loss than have the purer limestones. — *from* Authors' abstract

07548 **Carr, Michael H.** Geologic map of the Maskelyne DA region of the Moon — Lunar Orbiter site II P-2, southeastern Mare Tranquillitatis, including Apollo landing site 1: U.S. Geol. Survey Misc. Geol. Inv. Map I-616 [ORB II-2 (100)], scale 1:100,000, text, 1970.

The Maskelyne DA region, at the southeastern edge of Mare Tranquillitatis, is in an area transitional between mare and terra. The terra-mantling unit is exceptionally smooth and combines many of the features of both terra and mare. Two mare ridges and two domes occur within the region. The extremely low crater frequency indicates a very young age, and the smooth unit may be volcanic in origin. The general text on geologic maps of the Apollo sites by N. J. Trask is included. — MCM

Carr, Michael J. *See* Stoiber, Richard E. 00213

07348 **Carson, David John Temple.** Metallogenic study of Vancouver Island [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2060B, 1970.

07349 **Carson, William Pierce.** Computerized lineament tectonics and porphyry copper deposits in S.E. Arizona and S.W. New Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2060B-2061B, 1970.

07618 **Carstea, D. D.; Harward, M. E.; Knox, E. G.** Formation and stability of hydroxy-Mg interlayers in phyllosilicates [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 4, p. 213-222, illus., tables, 1970.

Hydroxyl-Mg interlayers were formed in montmorillonite and vermiculite by adding $MgCl_2$ and NaOH in amounts to give a wide pH range; resulting chloritic intergrades were examined after 10 days, 6 months, and 1 year, for stability to dissolution treatments. Interlayer formation was favored in alkaline conditions. Resulting interlayered montmorillonite closely resembled chlorite. Amount of interlayers, initially greater in montmorillonite, decreased with time in both minerals but more sharply in vermiculite. Starting with Na_2CO_3, all sequential treatments except boiling NaOH produced only minor changes in basal spacings and CEC of the interlayered montmorillonite; the second diothionite-citrate treatment removed most synthetic interlayers from vermiculite. In samples prepared by such treatments for analysis, these changes must be recognized in interpretation of data for clay mineral identification and characterization. — GDC

07426 **Casanova, Richard.** An illustrated guide to fossil collecting (revised edition): Healdsburg, Calif., Naturegraph Publishers, 128 p., illus., 1970; originally published 1957.

This rather comprehensive little book in its first hundred pages constitutes a small-scale textbook of paleontology and historical geology, with sections on: history of paleontology and fossil collecting; types of fossil preservation; classification of animal and plant kingdoms to class or subclass level, with illustrated examples of important fossil forms; geologic time scale, with brief descriptions of geology and climate of each period or epoch and the kinds of animal and plant life recorded from each; and paleoecology. In the remainder of the book are sections on collecting and preparation techniques, notes on collecting localities in the United States by states, and a reading list. — VMJ

07561 **Cate, Addison S.; Heyman, Louis.** Regional geologic setting of western Pennsylvania, [Chap.] 2 *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 3-7, illus., 1970.

Western Pennsylvania is in the Appalachian Plateaus Province. The ancient drainage pattern, established on a flat north- and west-sloping plain formed the topographic relief which gradually increased as streams cut down into the plateau. The advance of the glaciers caused the rivers of western Pennsylvania to flow generally southward. Glacial advances and retreats left a veneer of glacial deposits and modified the relief. Allegheny County, however, was not glaciated. Outcropping rocks are of Pennsylvanian or Permian age and form the Pennsylvanian System. Below the surface of Pittsburgh about 16,000 feet of sedimentary rocks, older than Pennsylvanian, overlie the metamorphic basement. Rocks are relatively flat-lying and stream divides are the high points of the land. Regionally, the Pittsburgh-Huntington trough-like basin extends NE and SW almost through Pittsburgh. All rock strata dip toward this axis. Toward the east the rocks become more sharply folded. — EH

07491 **Cater, Fred W.** Geology of the salt anticline region in southwestern Colorado, *with a section on* Stratigraphy by Fred W. Cater and Lawrence C. Craig: U.S. Geol. Survey Prof. Paper 637, 80 p., illus., geol. map, 1970.

This report deals with the general geology of the salt anticline region of southwestern Colorado, an area of about 1,057 sq mi. Crystalline rocks of Precambrian age and sedimentary rocks ranging in age from Pennsylvanian to Quaternary are exposed in the area. The crystalline rocks, gneiss, schist, and quartzite, crop out only on the Uncompahgre Plateau or its flanks. They have been extensively intruded by a gray medium-grained somewhat gneissic granite and by a younger, rather coarse-grained pink granite. Cutting these rocks are dikes of pegmatite, aplite and lamprophyre. The sedimentary rocks, with a known maximum thickness of 15,000 feet, are largely nonmarine deposits of conglomerate, arkose, sandstone and shale. Some sandstone was wind deposited. Marine deposits consist of evaporites, limestone, shale and sandstone. — *from* Author's abstract

07492 **Cater, Fred W.; Craig, Lawrence C.** Stratigraphy, *in*Geology of the salt anticline region, southwestern Colorado: U.S. Geol. Survey Prof. Paper 637, p. 5-50, illus., 1970.

Precambrian crystalline rocks crop out in Unaweep Canyon and on the flanks of the Uncompahgre Plateau. Sedimentary rocks of Pennsylvanian to Quaternary age underlie the rest of the area. Pennsylvanian salt and gypsum beds, partly intrusive into younger rocks, and forming cores of salt anticlines, are overlain by marine limestones grading into conglomerate and arkose of Pennsylvanian and Permian age. Lower Triassic shale, sandstone and conglomerate rest on these beds unconformbaly and are unconformably overlain by Upper Triassic shale and sandstone. Jurassic sandstones wedge out in places and the Jurassic Morrison Formation of shale, mudstone and sandstone blankets the Pennsylvanian intrusions. Cretaceous marine shale and stream-deposited conglomerate, sandstone and shale were deposited fairly uniformly over the area. No rocks of unquestioned Tertiary age occur. Quaternary deposits of fanglomerate, partly consolidated shale and sandstone and terrace gravels occur locally. — EH

07297 **Cernock, Paul John.** Sound velocities in Gulf of Mexico sediments as related to physical properties and simulated overburden pressures [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2858B-2859B, 1970.

00225 **Chamberlain, C. Kent.** Bathymetry and paleoecology of Ouachita geosyncline of southeastern Oklahoma as determined from trace fossils: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 34-50, illus., tables, 1971.

Trace fossils in the Mississippian-Pennsylvanian rocks of the Ouachita Mts. define a basin-to-shoal bathymetric profile. They include a deep-basin assemblage (Nereites) in the central Ouachitas, transitional assemblage (Chondrites) in the lower Atoka Formation of the frontal Ouachitas, littoral to bathyal assemblage (Cruziana and Zoophycos) in the Wapanucka Limestone, and shallow-shelf assemblage (Cruziana) in the upper Atoka Formation of the Arkoma basin. Persistence of distinctive trace-fossils in the central Ouachitas attests to the hospitality of the flysch environment in a deep basin. In the frontal Ouachitas, as the north slope of the geosyncline shifted north, the shallow-water environment was replaced by a flysch environment, and dwelling and feeding burrows were replaced by feeding trails and feeding burrows. Littoral trace fossils occur on the southern edge of the Arkoma basin. — *from* Author's abstract

Chan, K. M. *See* Manheim, F. T. 07151

07288 **Chandra, Umesh.** Analysis of body wave spectra for earthquake energy determination [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2771B-2772B, 1970.

07547 **Chao, E. C. T.; Boreman, Judith A.; Minkin, Jean A.; James, Odette B.; Desborough, George A.** Lunar glasses of impact origin — Physical and chemical characteristics and geologic implications: Jour. Geophys. Research, v. 75, no. 35, p. 7445-7479, illus., tables, 1970.

Occurrences, relative abundance, optical properties, and chemical composition were studied to assess importance of lunar glasses with respect to bulk composition, apparent age, and origin of regolith. Glasses show a wide range of compositions which tend to group; they probably represent composition of parent materials. Heterogeneous impact glasses are characterized by pronounced schlieren, abundant vesicles, and inclusions of mineral fragments and small nickel-like particles; chemical compositions vary, but range is restricted. They are probably derived by impact fusion of breccias or fines. Composition of crater glass lining small pit-craters is highly dependent on crater size relative to crystal or fragment size of the substrate. Bulk chemical composition of Apollo 11 breccias and fine fines can be obtained by combining 66-82 wt percent ilmenite basalt, 17-28 percent plagioclase-rich glass, and 1.5-6 percent olivine-rich glass. Probably glasses play a critical role in explanation of isotopic concentration of Rb, Sr, U, Th, and Pb that determine apparent age of lunar regolith. — *from* Authors' abstract

07458 **Chenevert, Martin E.** Adsorptive pore pressures of argillaceous rocks, Chap. 30 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 599-627, illus., tables, 1970.

A method is presented by which absorptive (negative) pore presures can be determined in argillaceous rocks by direct measurement of aqueous vapor pressure and the application of a basic energy-pressure relationship. Data for adsorptive pore pressures as low as -46,000 psi are reported. It is concluded from experimental data that adsorptive pore pressures are developed within argillaceous rocks when water is removed. Pressures can be determined by indirect measurement and should be used in computing effective stress in such rocks. Rock weakening by water adsorption is shown to be caused by a decrease in effective confining stress of the rock. — VSN

07350 **China, William.** Structural and mineralogical studies at the Homestake mine, Lead, South Dakota [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2061B, 1970.

07160 **Chipp, E. R.** Geology and geochemistry of the Chandalar area, Brooks Range, Alaska: Alaska Div. Mines and Geology Geol. Rept. 42, 39 p., illus., tables, geol. map, 1970.

The Chandalar area is the easternmost well-known gold district in a mineralized belt in the Wiseman and Chandalar quadrangles of northern Alaska and contains some of the highest grade gold-quartz lodes in the interior. In July and August, 1969, 63 sq mi were mapped and stream sediment and bedrock samples collected. The lithology and structure of the area are described. Known gold mineralization is confined to a north-northeast trending zone including upper Big Creek, and Tobin, Little Squaw and Big Squaw Creeks. Small gold-quartz veins are best developed along N. 57° W. trending normal faults and E-W trending joints near the fault zones, chiefly in phyllite in fault contact with schist or quartzite. Gold, arsenopyrite, galena, sphalerite, and pyrite are minor constituents of the veins. Gold is often in native form. Stream sediments contain anomalous copper and silver values in the north-northeast trending zone and anomalous values of lead and other elements in the northwestern area. — *from* Author's abstract

07596 **Chmelik, Frank Bernard.** An investigation of changes induced in macrostructures of pelitic sediments during primary consolidation [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1431B, 1970.

00268 **Christensen, N. I.** Shear wave propagation in rocks: Nature, v. 229, no. 5286, p. 549-560, illus., 1971.

Recent experiments have demonstrated striking similarities in elastic wave propagation through rocks and single crystals. In particular, two shear waves with mutually perpendicular displacements and different velocities are commonly propagated through metamorphic rocks, and have been observed in several igneous rocks. In all cases the observed anisotropy seems to be a result chiefly of preferred mineral orientation. It is probable that many regions of the Earth's crust and mantle are anisotropic, hence two shear waves should propagate through these regions; possibly the arrival of one is often masked by the energy of the other. — DBV

07533 **Christiansen, E. A.** Geology and groundwater resources of the Wynyard area (72P), Saskatchewan: Saskatchewan Research Council Geology Div. Map 10, scale 1:250,000, sections, text, 1970.

The geologic map includes contour lines on the top of the Lower Colorado Group. Sections include a base of ground-water exploration, defining the depth beyond which it is considered uneconomic to explore for ground water. Wells in the Oldman aquifer yield only small quantities of water; those in the Wynyard sand and gravel aquifer should yield 10,000 to 1,000,000 gpd. Glacial drift aquifers are the principal source of ground water. — ESL

07339 **Clark, Robert Owen.** The morphology of slope profiles — A statistical method to critically analyze the slope hypotheses of William M. Davis, Walther Penck, and Lester C. King [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2048B-2049B, 1970.

00293 **Clark, Sandra H. B.; Foster, Helen L.** Geochemical and geological reconnaissance in the Seventymile River area, Alaska: U.S. Geol. Survey Bull. 1315, 21 p., illus., table, 1971.

Geochemical data were secured from 322 stream-sediment samples, 207 rock samples, and 76 soil samples collected in the Seventymile River area. Geochemical anomalies occur in the Flume Creek-Alder Creek, Crooked Creek, American Creek, and Eagle Bluff areas. Gold in the Flume Creek-Alder Creek area south of the Seventymile River is believed to be associated with ultramafic bodies in a fault zone. Placer gold and other metals in anomalous amounts in stream sediments north of the Seventymile River in the Crooked Creek area may be related to dikes and faults that cut Tertiary and Tertiary(,) sedimentary rocks. Geochemical sampling in the American Creek and Eagle Bluff areas did not define any new mineral deposits, but several anomalies of unknown origin, particularly in the Eagle D-2 and D-3 quadrangles, are worthy of further investigation. — Authors' abstract

Clarke, G. K. C. *See* Classen, D. F. 00267

00267 **Classen, D. F.; Clarke, G. K. C.** Basal hot spot on a surge type glacier: Nature, v. 229, no. 5285, p. 481-483, illus., table, 1971.

Deep temperature measurements of ice on the Fox Glacier, Yukon, indicate a zone of basal ice at the pressure melting point, and the discovery of this temperate basal ice supports surge theories which require basal melting. An estimate of geothermal heat flow was made in one hole and gave a value of 2.34 μ cal per sq cm per sec, but the interpretation of the measured temperature gradient as a geothermal gradient is suspect because of the shallowness of the hole and large topographic distortion. The surge behavior of the Fox Glacier must surely relate to its remarkable thermal regime, but whether the observed hot spot is the cause or effect of its surge activity is still open to question. — DBV

07636 **Clayton, Keith.** Apollo looks at the U.S.A.: Geog. Mag., v. 43, no. 3, p. 177-182, illus., 1970.

On an Apollo flight beginning in March 1969, a series of photographs was taken of the United States and Mexico at low latitudes, with several shots looking northward. They demonstrate a generalization of most of the human detail and stress the broader patterns of relief and vegetation. Photographs of Delaware, Maryland, and Carolina, of South Carolina's Atlantic seaboard, the Mississippi Valley, desert and snowy mountains, cultivation and relief are included and are interpreted in the text. — EH

07168 **Clements, T. H., Jr.; Sandy, John.** Gravity survey of Marion County, Alabama: Alabama Geol. Survey Circ. 61, 58 p., illus., tables, 1970.

A gravity survey of 1,110 gravity stations was made in Marion County from 1965-68 over an area of about 735 sq mi. The most prominent gravity feature is a maximum centered near Hamilton, due north of the Hamilton gas field and with about 4 mgals closure. Other features mapped as maxima could indicate significant geologic structures and could have potential for hydrocarbon production, and most probably indicate areas where high-density dolomites of the Knox Group have been folded or faulted to a position nearer the surface than in surrounding areas. — *from* Authors' abstract

07170 **Clements, T. H., Jr.; Sandy, John.** Gravity survey of Winston County, Alabama: Alabama Geol. Survey Circ. 63, 52 p., illus., tables, 1970.

A gravity survey consisting of 950 gravity measurements over an area of about 630 sq mi was made from 1965-68 in Winston County. The southern flank of a 50-mgal gravity maximum extending southward from Lawrence County covers most of Winston County and is the most prominent feature mapped; if not due to basement uplift, it may represent a basin containing an abnormally thick accumulation of the Knox Group. The gravity maximum may be produced because the dolomite in the Knox is denser than the underlying granite or overlying sedimentary formations. Strati-

graphic pinchouts and porosity traps may exist along the rim of the inferred basin. Other maxima considered prospective for oil and gas accumulation probably indicate areas where Knox Group dolomites have been folded or faulted to a position nearer the surface than in surrounding areas. — *from* Author's abstract

07271 **Clendening, John Albert.** Sporological evidence on the geological age of the Dunkard strata in the Appalachian Basin [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2762B, 1970.

Cline, Lewis M. *See* Ostrom, Meredith E. 07422

07598 **Cocke, Julius Marion.** Dissepimental rugose corals of Pennsylvanian Missourian rocks of Kansas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1432B, 1970.

Coe, K. *See* Bridgwater, D. 07472

Coffman, C. B. *See* Fanning, D. S. 07629

07657 **Cohee, George V.** Stratigraphic nomenclature — Principles and procedures, *in* Geological seminar on the North Slope of Alaska, Palo Alto, Calif., 1970, Proc.: Los Angeles, Calif., Am. Assoc. Petroleum Geologists Pacific Sec., p. H1-H3, illus., discussion, 1970.

A plea is made for extreme care and consideration in selecting stratigraphic names for formations on the North Slope of Alaska. Reference is made to the excellent work done in mapping of the Naval Petroleum Reserve in the 1940's. The name should preferably be a well-known geographic feature, and on the North Slope rivers, creeks, and such features can be used. The term "Formation" should be used only when no single lithology characterizes the unit. The use of group, member, and bed, and the concept of time-stratigraphic unit are examined also. Geologists are urged to follow the North American code of stratigraphic nomenclature. — VSN

07488 **Cohen, Philip; Franke, O. L.; Foxworthy, B. L.** Water for the future of Long Island, New York: New York Water Resources Bull. 62A, 36 p., illus., abridged, 1970; originally published 1968.

This booklet summarizes major highlights of "An atlas of Long Island's water resources" (Cohen et al., New York Water Resources Comm. Bull. 62, 1968) [*see* Abstracts of North American Geology, Nov. 1968], to which readers are referred for accuracy and original source material. Background information is given in the first three sections of this booklet; water-management possibilities are considered in the fourth section; and several conclusions and recommendations are given in the last section. Water managers generally agree that the water supply for most of Long Island will continue to be derived from the local fresh-water sources for at least the remainder of this century. A glossary explains selected technical terms used only where necessary. — GDC

07637 **Colvin, John M., Jr.** Geologic map of the Sunrise quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 50-NW, scale 1:24,000, separate text, 1970.

Resources mined in the Sunrise quadrangle are chert from the Fort Payne and Warsaw Formations, iron ore in Mississippian residuum, and phosphate which is as much as 30 in thick at the base of the Chattanooga Shale. Potential resources are limestone and sand and gravel. — MCM

Comer, George H. *See* Kunkle, Samuel H. 00315

07351 **Cook, David Olney.** Sand transport by shoaling waves [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2061B, 1970.

07516 **Cook, John C.** RF electrical properties of bituminous coal samples: Geophysics, v. 35, no. 6, p. 1079-1085, illus., tables, 1970.

In order to estimate the transparency of coal in place to radio waves in the VHF range, some preliminary measurements were made on freshly collected samples of two bituminous coals. A capacitance test cell and an RF impedance bridge were used. The dielectric constant was found to be fairly uniform, ranging between about 2 and 4 for all frequencies. The RF losses were equivalent to a resistivity in the range of 500 to 2000 ohm-m at 100 Mhz. Equivalent resistivities at lower frequencies were greater, roughly inversely proportional to frequency. These coals could carry 100 Mhz waves over distances of the order of 50 m with 60 db of attenuation, and 1 Mhz waves, for 1 to 10 km. However, the clay and pyrite veins occurring in the Pittsburgh coal bed, where they are large and numerous, may well obstruct radio waves (especially of horizontal polarization). — Author's abstract

Cooper, Fred G. *See* Kessler, L. G., 2d. 07330

07623 **Corey, J. C.; Wawkins, R. H.; Overman, R. F.; Green, R. E.** Miscible displacement measurements within laboratory columns using the gamma-photoneutron method: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 854-858, illus., tables, 1970.

When fluid in a porous medium is displaced by a second fluid that is miscible with the first, a transition zone exists between the two; its length and location in a soil column is difficult to measure *in situ*. When one of the fluids contains D_2O as a major component, a new gamma-photoneutron method readily measures the transition zone. Using this method in experiments, the interfaces between light water (H_2O) displacing heavy water (D_2O) and between heavy water plus sodium nitrate were followed nondestructively through laboratory soil columns during miscible displacement. The measured apparent diffusion coefficient was not independent of column length with these solutions. — *from* Authors' abstract and Soil brief

00308 **Cowen, Richard.** The food of articulate brachiopods — A discussion: Jour. Paleontology, v. 45, no. 1, p. 137-139, 1971.

McGammon (1969) has suggested that brachiopods live largely on dissolved nutrients, in contrast to the opinion of Rudwick (1962) and others that they feed on plankton. There are two ways of resolving this conflict, assuming all observations are valid: first, that deeper-water and shallow-water brachiopods have different modes of life, and/or, that brachiopods in general feed on plankton and dissolved nutrients, in different proportions depending on habitat, latitude, depth and season. — Author's abstract

Cox, Allan. *See* Marshall, Monte. 00272

Coxey, James R. *See* Socolow, Arthur A. 07487

Craig, Lawrence C. *See* Cater, Fred W. 07492

Cramer, George H. *See* Kesler, Stephen E. 00301

00298 **Crawford, C. B.; Sutherland, J. G.** The Empress Hotel, Victoria, British Columbia — Sixty-five years of foundation settlements [with French abs.]: Canadian Geotech. Jour., v. 8, no. 1, p. 77-93, illus., tables, 1971.

Construction of the Empress Hotel began in 1904 on a site reclaimed from the sea. The combined load of the fill and the structure has caused several feet of compression in the underlying marine silty clay. Fortunately, settlement observations have been made regularly since 1912 and the nature of the foundations and the structure allow reliable extrapolation back to the first loading. This paper describes the site, the applied loading, the settlements observed, and the results of laboratory tests on samples recently obtained. The observed primary and secondary consolidation settlements are compared with computed values. — Authors' abstract

Cribbs, S. C. *See* Montford, B. 00331

Cross, Christine H. *See* Warren, Harry V. 07419

07532 **Crosthwaite, E. G.; Mundorff, M. J.; Walker, E. H.** Ground-water aspects of the lower Henrys Fork region, eastern Idaho: U.S. Geol. Survey Water-Supply Paper 1879-C, p. C1-C22, illus., 1970.

Irrigation wells open to the basalt under the Snake River Plain in the northwestern and western parts of the area, and to the basalt, sands and gravels under alluvial plains in the central part yield large amounts of water with small drawdowns. Wells in silicic volcanic rocks and interbedded ash, pyroclastics and sedimentary deposits beneath the Rexburg Bench to the southeast yield less water. The regional water table slopes southwest beneath the plains and is recharged by precipitation and by water moving downward, and in part laterally, from a perched water body; beneath the Rexburg Bench it moves generally northwestward. Recharge to the regional water table averages 725,000 acre-feet annually. Total withdrawals in 1962 of about 25,000 acre-feet for irrigation and 10,000 acre-feet for domestic, municipal and stock supplies caused little decline in the water table. — *from* Authors' abstract

07450 **Cruz, Rodolfo V. de la; Goodman, Richard E.** Theoretical basis of the borehole deepening method of absolute stress measurement, Chap. 20 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 353-376, illus., tables, discussion, 1970.

The theoretical basis is discussed for the borehole deepening method of absolute stress measurement in rocks. To perform stress measurement at a remote point (distance greater than four times hole radius) by borehole deepening, a borehole is drilled to the center of the region to be tested. Redistribution of initial stresses occur with introduction of the borehole and associated deformations take place. Displacements of points remote from the bottom of the hole will be essentially uniform in magnitude, while displacements of points close to the hole bottom will be reduced by presence of bottomhole material. Along the hole length deformations have components in all coordinate directions, but radial deformation is more amenable to measurement. Therefore, the proposed measuring technique is concerned with this component. — VSN

Cummings, T. Ray. *See* Bloxham, W. M. 07608

Cunningham, R. L. *See* Petersen, G. W. 07428

07479 **Cutcliffe, William E.** The role of applied geology in producing high friction aggregate, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 105-117, illus., table, 1970.

The New York State Department of Transportation specifications for high friction coarse aggregate are: a carbonate rock with more than 10 percent plus 200 mesh insoluble residue in hydrochloric acid, or a blend of greater than 20 percent noncarbonate aggregate and less than 8 percent of a standard N.Y.S.D.O.T. M4 coarse aggregate with no insoluble residue limits. It was necessary to evaluate all potential aggregate strata in the state, considering lithologic factors such as rock type, mineral composition, texture, and grain size relative to road wear and tendency to polish. The program requires each producer to submit a geologic report outlining areas of high friction aggregate and to locate the aggregate by painting quarry faces to assure quality control throughout the production season. Systematic sampling will be supervised by state engineering geologists. — *from* Author's abstract

07625 **Dankert, Wayne N.; Drew, James V.** Pedogenic distribution of zinc in Mollisols and associated Entisols in Nebraska: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 916-919, tables, 1970.

The distribution of total Zn in the fine earth and noncarbonate clay of Moody and Holdrege (Mollisols) and Crofton and Coly (Entisols) in Nebraska suggests that Zn is released from soil minerals and cycled by vegetation during biopedogenic weathering, becomes associated with noncarbonate clay in the A horizons following decomposition of plant residues, and moves to B horizons with eluvial clay. — Soil brief

07180 **Davidson, A.** Eskimo Point and Dawson Inlet map-areas (north halves), District of Keewatin, 55E and 55F (north parts) [with French abs.]: Canada Geol. Survey Paper 70-27, 21 p., illus., geol. maps, 1970.

Eskimo Point and Dawson Inlet map-areas adjoin the west side of Hudson Bay and lie in barren grounds of southern Keewatin. Oldest rocks (metamorphosed, deformed Archean volcanic and sedimentary) are intruded by and wrapped around large plutonic complexes of the Kenoran Orogeny and contain chiefly tonalite but ranging from gabbro to granite. After intrusion by diabase dikes, this terrane was eroded and overlain, at least in part, by sediments of the Aphebian Hurwitz Group. Hudsonian metamorphism, deformation, and emplacement of granite have strongly affected the extreme southeastern area, and define the southern limit of the northeastern part of the Ennadai-Rankin Inlet greenstone belt. North of this limit the Hudsonian orogenic overprint is insufficient to mask older structures and lithologies. Poorly exposed iron-formations and scattered zones of sulfide mineralization warrant further attention from prospectors. — *from* Author's abstract

00257 **Davies, Geoffrey F.; Brune, James N.** Regional and global fault slip rates from seismicity: Nature Phys. Sci., v. 229, no. 4, p. 101-107, illus., tables, 1971.

Rates of fault slip calculated from the seismicity of the world's chief seismic regions agree well with the predictions of "rigid plate tectonics." Global fault activity seems to have decreased five-fold in the past seventy years, indicating that earthquakes are coupled on a global scale within decades. This article also discusses the possible recurrence of a period of high activity. — Authors' abstract

07335 **Davis, Darrell E.; Taylor, Ronald S.; Brown, Karen E.; Russell, E. E.; Keady, D. M.; Welby, Charles W.; Dodge, C. F.** Type locality descriptions, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 318-335, illus., 1970.

The type localities of Beaumont Formation (Late Pleistocene), Clayton Formation (Paleocene), Fort Worth Formation (Lower Cretaceous), Tombigbee Sand Member of the Eutaw Formation Gulfian Series (Upper Cretaceous), Winona Member of the Lisbon Formation (Middle Eocene), Woodbine Formation (Upper Cretaceous), and the Arlington, Dexter, Lewisville, and Rush Creek Members of the Woodbine Formation are described. The location, namer(s), age, correlation, original description, column and location map, and source of information are given for each. — DBV

Davis, Richard A., Jr. *See* Ostrom, Meredith E. 07422

07500 **Davis, W. E.; Stewart, J. H.** Aeromagnetic and generalized geologic map of the Austin area, Lander County, Nevada: U.S. Geol. Survey Geophys. Inv. Map GP-694, scale 1:125,000, separate text, 1970.

The Austin area is underlain by a thick sequence of intensely folded and faulted lower Paleozoic sedimentary rock that has been intruded by Jurassic igneous rock and buried in places by a thin cover of Tertiary volcanic rock. A large and varied number of mineral deposits are found mainly in silver-bearing veins in quartz monzonite. A high magnetic intensity zone over the Toiyabe Range and upper Grass Valley is attributed to the Austin pluton. A high along the south crest of the range may be caused by a concealed extension of the plutonic rock. The prominent magnetic low east of Austin occurs over quartz monzonite, concealed locally by volcanic rocks and alluvium. A positive anomaly of about 70 gammas in the northwestern section is probably caused by induced and remanent polarization in intrusive rock. Ore deposits occur mainly in anomalous parts of the area, but are not indicated directly by specific magnetic features. — MCM

Delavault, Robert E. *See* Warren, Harry V. 07419

00303 **Dennison, John M.; Johnson, Robert W., Jr.** Tertiary intrusions and associated phenomena near the thirty-eighth parallel fracture zone in Virginia and West Virginia: Geol. Soc. America Bull., v. 82, no. 2, p. 501-507, illus., 1971.

Recognition of Eocene igneous intrusions in Highland County, Va., prompted a search for related phenomena. Temperature of thermal springs, site of maximum uplift of the Schooley surface, and a regional Bouguer gravity anomaly in excess of -80 mg occur within 20 mi of the common point of Highland and Bath Counties, Va., and Pocahontas County, W.Va. The Highland County rocks of Eocene age are the most recent expression of volcanism along a deep-seated crustal fracture that lies transverse to the Appalachians near the 38th parallel. Rocks above the fracture zone contain igneous injections, flows, and pyroclastics of late Precambrian, Devonian, Triassic, Jurassic, and Eocene. Dating data suggest westward migration with time of intrusive centers. The fracture seems to have been present and active for more than 0.8 b.y. and may still be a zone of weakness. — *from* Authors' abstract

Desborough, George A. *See* Chao, E. C. T. 07547

07658 **Detterman, Robert L.** Sedimentary history of Sadlerochit and Shublik Formations in northeastern Alaska, *in* Geological seminar on the North Slope of Alaska, Palo Alto, Calif., 1970, Proc.: Los Angeles, Calif., Am. Assoc. Petroleum Geologists Pacific Sec., p. O1-O13, illus., 1970.

The Sadlerochit Formation is a major stratigraphic unit in northeastern Alaska with a major oil field producing from sandstones in the upper part. It represents deposition in a major marine transgressive phase (Echooka facies) beginning in Late Permian and in a regressive phase (Ivishak facies). The depositional environment for the Echooka Member was entirely marine but probably shallow; the source area was to the north. The main sandy part of the upper Ivishak Member is a major constructive deltaic system; massive sandstone near the top represents a strand plain or possibly a barrier bar deposit and may be in part subaerial. The overlying Shublik Formation extends across nearly the entire width of northern Alaska. The main part is limestone, dolomitic limestone, and dolomite with calcareous siltstone; it is abundantly fossiliferous and of Middle to Upper Triassic age. This formation is possibly the major source beds for the petroleum in northern Alaska. — VSN

deWit, C. T. *See* Wierenga, P. J. 07621

Dietrich, John W. *See* Maxwell, Ross A. 07206

07433 **Dixon, J. B.; Moore, D. E.; Agnihotri, N. P.; Lewis, D. E., Jr.** Exchange of diquat^{2+} in soil clays, vermiculite, and smectite: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 805-808, illus., tables, 1970.

A direct relationship was shown between K^+-diquat^{2+} exchange and layer charge density of smectites and vermiculites. Hydroxy-Al interlayers had little influence on the exchange of diquat^{2+} in vermiculite and in montmorillonite. The exchangeability of diquat^{2+} in a diverse group of soil clays was directly related to vermiculite content. Exchangeability of diquat^{2+} in montmorillonitic Houston and Iredell soil clays and their K^+ fixing ability on oven drying indicate that vermiculite may have an important influence on their K^+ exchange reactions. — Soil brief

07412 **Dixon, Jay D.** Analysis of tunnel support structure with consideration of support/rock interaction [abs.]: Mining Eng., v. 22, no. 9, p. 55, 1970.

07382 **Dodds, Robert Brian.** Stress wave propagation in prepared clay specimens [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1943B, 1970.

Dodge, C. F. *See* Davis, Darrell E. 07335

07257 **Doell, Richard R.** Preliminary paleomagnetic results, Leg 5, Chap. 22 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 523-524, table, 1970.

Data from 17 samples from 4 stations of Leg 5 in the Pacific Ocean, were obtained with a slow-speed spinner magnetometer employing fluxgate sensors and phase-lock

detection. The samples were partially demagnetized within the Earth's field; remanent magnetic measurements were made within a magnetic shield. — ESL

Doerschlag, Larry A. *See* Schoenwetter, James. 00317

Dolukhanov, P. M. *See* Grachev, A. F. 07215

07651 **Donahue, Jack; Wexler, James A.** Worm burrowing in north-central Pacific [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 7, p. 539-540, 1970.

07646 **Dorman, LeRoy Myron.** The theory of the determination of the Earth's isostatic response to a concentrated load [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1354B, 1970.

Dott, R. H., Jr. *See* Stanley, K. O. 00224

Douglass, John R. *See* McKee, Edwin D. 00200

07352 **Dowty, Eric.** Crystal chemistry of titanian garnet, site distribution and valence of cations [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2062B-2063B, 1970.

Drew, James V. *See* Dankert, Wayne N. 07625

07517 **Duckworth, K.** Electromagnetic depth sounding applied to mining problems: Geophysics, v. 35, no. 6, p. 1086-1098, illus., 1970.

A simplified approach to electromagnetic depth sounding in the variable coil separation mode is described. The method was developed by scale model studies and consideration of the geometry of the dipole magnetic field. Its use is limited to nonmagnetic, highly conductive plane structures or nonmagnetic thin sheets of moderate to high conductivity. Field tests indicate the method to be capable of providing good depth estimates over quite steeply dipping structures. The effect of conductivity anisotropy proved to be readily recognizable in the field tests. — Author's abstract

00299 **Duguid, D. R.; Forbes, D. J.; Gordon, J. L.; Simmons, O. K.** The slurry trench cut-off for the Duncan Dam [with French abs.]: Canadian Geotech. Jour., v. 8, no. 1, p. 94-108, illus., tables, 1971.

A slurry trench cut-off was constructed for the Duncan Dam [British Columbia]. Two failures of the trench wall occurred during construction, one of which required relocation of a portion of the cutoff to avoid delaying construction of the dam. The relocated cut-off was successfully constructed from a higher ground elevation, using a denser slurry, produced by mixing in more silt. To analyze the failures a nomograph was developed which can be used to determine the required slurry density for trench wall stability. The stability analysis, first developed by Morgenstern and Amir-Tahmasseb was confirmed. The hydrostatic head drop across the cut-off varies from 85 to 90 percent of the gross head on the dam. Differential settlement of almost 10 ft (3 m) has occurred along the cut-off after completion without detrimental effects. — *from* Authors' abstract

00285 **Dunlap, John B., Jr.** Paleoecology defines zones which may bear gas and oil: World Oil, v. 172, no. 4, p. 56-58, illus., 1971.

A new method is being used to map successive hingelines and trace back the time of paleo-continental shelf-edge breaks related to deltas formed during the Oligocene, Miocene, Pliocene and Pleistocene periods. These vast sedimentary structures store about one-half of the offshore Louisiana hydrocarbon reserves. — Author's abstract

07332 **Dunlap, John B., Jr.** Paleoecology as an exploration tool, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 280-283, illus., 1970.

Paleoecology can be a valuable tool in any exploration program. For proper interpretation, it is important that standard criteria for paleoecologic data be used without attempting to alter them to fit preconceived ideas. Paleobathymetric maps constructed from properly evaluated paleoecologic data can easily locate ancient continental shelf-slope breaks (depositional hinge lines), the most favorable zones for generation of hydrocarbons. Such maps also are important tools when used for sand prediction. When used in conjunction with structure maps they can aid reconstruction of the geologic history of an area. — DBV

07482 **Dunn, James R.; Wallace, William A.** Mineral resources, computers and the environmental context, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 153-163, illus., tables, 1970.

Research at Rensselaer Polytechnic Institute to determine potential of computer and mathematical techniques in planning for mineral resource development and utilization includes researchers in mathematics, geology, and architecture with management engineering as the coordinating thread. The test area for the initial phase of the computer simulation study is the Capital District area of New York and its hinterlands. Input includes data on geology, proposed transportation systems, mineral extraction, and demographic characteristics as well as development and plans. The geologic input consists of an inventory for each of the 1,200 sq mi of the quantity and quality of stone and sand and gravel resources. Economic impact of new specifications, concepts of raw material use, construction techniques, and transportation modes can be determined and alternate plans analyzed. The ultimate purpose is to integrate the nonreplenishable components of the environment. — *from* Authors' abstract

Dunn, James R. *See* Socolow, Arthur A. 07487

07499 **Dutton, Carl E.; Bradley, Reta E.** Lithologic, geophysical, and mineral commodity maps of Precambrian rocks in Wisconsin: U.S. Geol. Survey Misc. Geol. Inv. Map I-631, 6 sheets, scale 1:500,000, separate text, 1970.

Sheets 1-3 show for northern Wisconsin lithologic data, magnetic and Bouguer gravity anomalies, and inferred areal geology of principal lithologic units; sheet 4 contains an explanation of units shown on sheet 3. Sheet 5 shows combined lithologic, geologic, and geophysical information for the southern part of Wisconsin and sheet 6 is a map of northern Wisconsin and part of Michigan indicating mineral commodity localities (Wisconsin only) and metamorphic zones. The text (15 p.) discusses principal map features and their interpretation: lithology, aeromagnetic and gravity data, Precambrian areal geology, and mineral deposits of southern Wisconsin. — MCM

07197 **Eakins, Gilbert R.** Geology and geochemistry at Kontrashibuna Lake, Lake Clark region, southwestern Alaska: Alaska Div. Mines and Geology Geochem. Rept. 20, 29 p., illus., tables, geol. map, 1970.

Mineralized areas are known in the Lake Clark region, but almost no production has resulted, partly because of difficult access and partly because of a lack of geologic information. A brief geologic and geochemical investigation was conducted around the perimeter of Kontrashibuna Lake by the writer during the 1969 field season. A reconnaissance geologic map was made and 230 geochemical stream sediment and soil samples were collected. Several copper, lead, and zinc anomalies were found, four of which suggest more detailed work. Stream sediment and soil sampling along the drainage below the Kasna Creek copper deposit was conducted as a test of geochemical sampling procedures. — Author's abstract

07251 **Eakins, Gilbert R.** An experiment in geobotanical prospecting for uranium, Bokan Mountain area, southeastern Alaska: Alaska Div. Mines and Geology Geol. Rept. 41, 52 p., illus., tables, 1970.

A project was conducted at the Ross-Adams uranium mine to determine the usefulness of various sample types in uranium exploration in Alaska; 421 samples of plants,

mulch, algae, and stream sediments were collected. The Ross-Adams ore deposit, uranium-thorium concentration in a stock of peralkaline granite, was selected because the mine has produced high-grade ore and the geology of the area is known. Highly anomalous uranium values were obtained from the ashed plants and other materials — the highest, 2396 ppm uranium, from lodgepole pine. Eleven assay maps give results of sampling; other maps show fracture pattern, mine workings, and radiometric surveys. Lodgepole pine is considered the most suitable plant for geobotanical prospecting in the area. — *from* Author's abstract

00248 **Eden, W. J.; Mitchell, R. J.** The mechanics of landslides in Leda clay — Reply [to 1971 discussion by M. J. Paul of 1970 paper]: Canadian Geotech. Jour., v. 8, no. 1, p. 148-149, 1971.

The original paper was published ibid., v. 7, no. 3, p. 285-296, 1970; *see* Abstracts of North American Geology, March 1971; discussion by Paul, ibid., p. 143-148, 1971, this issue. — ESL

Edgerton, Curtis D. *See* Heyman, Louis. 07568

07552 **Eggleton, R. E.; Offield, T. W.** Geologic maps of the Fra Mauro region of the Moon — Apollo 14 pre-mission maps: U.S. Geol. Survey Misc. Geol. Inv. Map I-708, 2 sheets, scales 1:250,000 and 1:25,000, separate texts, 1970.

The maps show the regional geologic setting of the landing area for the Apollo 14 mission to the Moon. The map area includes part of the crater Fra Mauro and the Fra Mauro Formation, a distinctive stratigraphic unit that underlies extensive areas around the Imbrium basin; three morphologic facies of the formation are recognized and mapped as separate informal members. Features of probable volcanic origin are along the west side of the map area — cones, domes, and sharply bounded ridge material. Crater materials range in age from pre-Imbrian to late Copernican. Faults are not conspicuously abundant, although there are two dominant structural trends — N-S and NE-SW. — MCM

Egleson, G. C. *See* Anderson, Raymond J. 07519

07246 **Ehrlinger, H. P., 3d; Jackman, H. W.** Lower Mississippi River terrace sands as a commercial source of feldspar: Illinois Geol. Survey Indus. Mineral Notes 43, 17 p., illus., tables, 1970.

Large deposits of low-grade feldspar sands, a potential source of the mineral feldspar, are present in five general areas in Illinois, but no feldspar is being produced commercially in the state. Feldspar for industrial use is imported from other states. The second in a series describing Illinois feldspar deposits and the methods used in Illinois State Geological Survey laboratories to produce commercial concentrates of feldspar, this report is concerned with the sands of the lower Mississippi River terrace and floodplains in southwestern Illinois, below the mouth of the Missouri River. Tests indicate that feldspar concentrates of commercial grade can be made from these sands. — Authors' abstract

07439 **Einstein, H. H.; Nelson, R. A.; Bruhn, R. W.; Hirschfeld, R. C.** Model studies of jointed-rock behavior, Chap. 6 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 83-103, illus., table, 1970.

Model studies are described to determine the effect of planar discontinuities on strength and deformability of a rock mass. A model material of gypsum plaster consisting of Hydrocal B-11, celite, and water, was used because of its similarity to brittle rocks. Results show that the model material behaves in a brittle manner at low confining stresses but becomes ductile at high confining stresses. Observed ductile behavior is caused by formation of multiple failure planes and possibly by plastic flow in constituent crystals. Strength and deformability of a model jointed rock depend on confining stresses, material properties, joint properties, joint inclination, and joint

spacing. The physical features observed on failure surfaces and the inclination of these surfaces give insight into failure mechanism. — VSN

00236 **Eldredge, Niles.** Patterns of cephalic musculature in the Phacopina (Trilobita) and their phylogenetic significance: Jour. Paleontology, v. 45, no. 1, p. 52-67, illus., 1971.

Triangular *dalmanitid*, circular *phacopid*, and ovoid *pterygometopid* glabellar muscle insertions are recognized in trilobites of Phacopina (Ordovician-Devonian); these have taxonomic importance, and suggest placement of the Pterygometopidae in the Phacopacea, rather than Dalmanitacea. The auxiliary muscles are interpreted as having expanded the digestive tract of the phacopids, whereas in the Dalmanitacea the muscles served more to activate the cephalic appendages. — REG

07601 **Eldredge, Robert Niles.** Geographic variation and evolution in *Phacops rana* (Green, 1832) and *Phacops iowensis* Delo, 1935, in the Middle Devonian of North America [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1433B-11434B, 1970.

07649 **Elliott, David.** Determination of flow laws in naturally deformed quartzites [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 7, p. 546, 1970.

Ellis, J. H. *See* Phillips, R. E. 07231

07624 **Ellis, J. H.; Barnhisel, R. I.; Phillips, R. E.** The diffusion of copper, manganese, and zinc as affected by concentration, clay mineralogy, and associated anions: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 866-870, illus., 1970.

Only small differences in the diffusion coefficients of Cu, Mn, and Zn at comparable concentrations were found for a given clay. The diffusion rates of Cu, Mn, Zn through clay minerals were of the order: kaolinite > illite > montmorillonite > vermiculite. The effect of the anions, Cl^-, NO_3^-, SO_4^-, and OAc^- upon diffusion of the cupric ion in montmorillonite was evaluated. The anion associated with the cupric ion affected the diffusion rate. The order of diffusion coefficients at a concentration of 0.5 meq/g of montmorillonite clay were: $CuCl_2$ > $Cu(NO_3)_2$ > $CuSo_4$ > $Cu(OAc)_2$. — Soil brief

00294 **Emiliani, C.** The last interglacial — Paleotemperatures and chronology: Science, v. 171, no. 3971, p. 571-573, illus., 1971.

The O-18/O-16 analysis and Th-230/Pa-231 dating of deep-sea cores showed that the last interglacial age, with an early major temperature maximum followed by two smaller ones, extended from 100,000 to 70,000 years ago and was preceded by a glacial age extending from 120,000 to 100,000 years ago. The O-18/O-16 analysis and Th-230/U-234 dating of speleothems confirm and refine these ages. — Author's abstract

07264 **Erel, Bilgin.** Physico-chemical model analysis for compressibility of pure clay [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2662B-2663B, 1970.

07181 **Ermanovics, I. F.** Geology of Berens River-Deer Lake map-area, Manitoba and Ontario and a preliminary analysis of tectonic variations in the area: Canada Geol. Survey Paper 70-29, 24 p., illus., table, geol. map, 1970.

The Berens River-Deer Lake map-area is underlain by massive and layered quartz monzonite and granodiorite which also constitute the dominant rock types in the northern part of the adjacent Hecla-Carroll Lake map-area to the south. Gneissose and layered quartz monzonite and granodiorite underlie 46 percent of the area, massive granodiorite 32 percent and leuco-quartz monzonite 19 percent; metadacite and metasedimentary gneiss constitute 3 percent. Tectonic variations in both map-areas is synthesized to three domains: (I) metavolcanic-sedimentary rocks; (II) an adjacent, hybrid mobile zone containing high-grade gneisses and basic plutonic

rocks; and (III) a sialic nucleus comprising massive and layered siliceous plutonic rocks. Domains I and II constitute a down-faulted remnant of the total volcanic-sedimentary tectogene, originally deposited on the sialic nucleus of domain III. — Author's abstract

Fairhurst, C. *See* Haimson, B. 07505

00197 **Fanale, Fraser P.; Nash, Douglas B.** Potassium-uranium systematics of Apollo 11 and Apollo 12 samples — Implications for lunar material history: Science, v. 171, no. 3968, p. 282-284, illus., 1971.

Apollo 11 and Apollo 12 lunar rock suites differ in their potassium-uranium abundance systematics. This difference indicates that relatively little exchange of regolith material has occurred between Mare Tranquillitatis and Oceanus Procellarum. The two suites appear to have been derived from materials of identical potassium and uranium content. It appears unlikely that bulk lunar material has the ratio of potassium to uranium found in chondrites. However, systematic differences in the potassium-uranium ratio between Apollo samples and crustal rocks of the Earth do not preclude a common potassium-uranium ratio for bulk Earth and lunar material. — Authors' abstract

07629 **Fanning, D. S.; Korcak, R. F.; Coffman, C. B.** Free iron oxides — Rapid determination utilizing x-ray spectroscopy to determine iron in solution: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 941-946, illus., table, 1970.

Rapid methods are presented for determining citrate-bicarbonate-dithionite extractable free iron. The methods utilize X-ray spectroscopy to determine the extracted iron. In addition to the fact that the oxidation state of the iron is not critical, the spectrograph is rapid mainly because it is sensitive over a very wide range of iron concentrations, hundreds or thousands of μg/ml, whereas atomic absorption is useful in the 0 to 20 μg/ml and colorimetry in the 0 to 4 μg/ml range. Thus, free iron extracts normally must be diluted for atomic absorption or colorimetry, but not for X-ray spectrographic analysis. — Soil brief

07387 **Farrell, William Elliston.** Gravity tides [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2069B, 1970.

Fatt, Irving. *See* Weinbrandt, R. M. 07459

00258 **Fenner, Peter; Kelling, Gilbert; Stanley, Daniel J.** Bottom currents in Wilmington submarine canyon: Nature Phys. Sci., v. 229, no. 2, p. 52-54, illus., 1971.

Data are presented on bottom currents near the head of Wilmington Canyon, which indents the outer margin of the continental shelf 140 km southeast of Delaware Bay. The measurements were made with Niskin Bottom Current Speed and Direction Recorders. The location of the four stations occupied, and current roses for each, are illustrated. There is abundant evidence for present bottom current activity in and around the head of the canyon, with velocities capable of moving fine to medium sand. This material is transported across the outermost shelf and trapped in the canyon head; once in the canyon, bottom sediment is acted on by axial currents of similar competency but possibly oscillatory character, which ultimately produce net down-canyon transport. — DBV

00322 **Fenwick, K. G.** Lang-Cannon Lakes area (central part), District of Kenora (Patricia Portion): Ontario Dept. Mines and Northern Affairs Prelim. Map P.665 (Geol. Ser.), scale 1 in. to 1/2 mi., text, 1971.

Bedrock in the map-area is Precambrian metavolcanics and metasediments surrounded and intruded by granitic rocks. Major structure in the western part is an isoclinal syncline; two foliations and several lineaments are noted. Possible gold, iron, and sulfide deposits are described. — ESL

00275 **Fertl, Walter H.; Timko, Donald J.** Association of salinity variations and geopressures in soft and hard rock: Log Analyst, v. 12, no. 1, p. 5-15, illus., tables, 1971.

In situ and surface measurements of salinity variations in formations penetrated by the drill bit in soft and hard rock indicate that changes in salinity are related to environmental conditions and tectonic features. Variations appear to be related to occurrence of overpressured formations; however, such correlations may be limited by the fact that formation salinities can vary quite markedly with rock stresses due to tectonics such as faulting, salt dome uplift, unconformities, and other local or regional geology. Salinity variations combined with other conventional logging parameters help pinpoint formations which exhibit severe borehole stability problems. Field case examples from the Gulf Coast area and Oklahoma are presented which illustrate the application of the salinity concept to several engineering and geologic problems. — *from* Authors' abstract

07244 **Fidler, Richard E.** Potential development and recharge of ground water in Mill Creek valley, Butler and Hamilton Counties, Ohio, based on analog model analysis: U.S. Geol. Survey Water-Supply Paper 1893, 37 p., illus., tables, 1970.

In 1964 nearly 30 percent of the water supply in Mill Creek valley (greater Cincinnati industrial area) was obtained from wells in the glacial-outwash aquifer underlying the valley; natural recharge to the aquifer is about 8.5 mgd. In 1964 total water use was about 30 mgd, of which 8.1 mgd was obtained from wells in the valley and the remainder imported. With rapid industrial expansion and population growth, demand for ground water is expected to exceed 25 mgd. The present study attempts to determine the feasibility of injection-well recharge systems. An electric analog model was used to test specific development plans, projecting past pumpage data to the years 1980 and 2000. Based on model analysis, from 3-8 injection wells (approximate input 2 mgd each) would reverse the trend in declining levels and provide adequate water for future demands. — *from* Author's abstract

07560 **Finn, Fenton H.** Charles R. Fettke, March 25, 1888-May 26, 1959, *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. v-vi, portrait, 1970.

07396 **Fisher, Frederick T.; Hoagland, Alan D.** Hydrologic investigation of the middle Tennessee zinc district [abs.]: Mining Eng., v. 22, no. 8, p. 37, 1970.

Fisher, P. S. *See* Skidmore, E. L. 07627

07329 **Fisher, W. L.; Proctor, Cleo V., Jr.; Galloway W. E.; Nagle, J. S.** Depositional systems in the Jackson Group in Texas — Their relationship to oil, gas, and uranium, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 234-261, illus., 1970.

Five main depositional systems of the Jackson Group in Texas are delineated through regional outcrop and subsurface investigation: (1) the Fayette fluvial-delta system, dominant in the central and eastern Texas Gulf Basin; (2) the South Texas strandplain-barrier bar system; (3) the lagoonal-coastal plain system landward of (2); the South Texas shelf system, gulfward of (2); and the Yazoo-Moodys Branch shelf system, beneath (1) and (2) and extending into Louisiana and Mississippi. Delineation of depositional systems and component facies facilitates definition of significant mineral trends (oil, gas, lignite, and uranium) that show the relationship between existing and potential productive areas. — DBV

07429 **Fiskell, John G. A.** Cation exchange capacity and component variations of soils of southeastern USA: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 723-727, tables, 1970.

Several methods for determining CEC were used for soils from this region selected to provide a wide range in acidity, clay mineralogy, clay content and organic matter. Buffered systems were used to measure CEC at pH 4.8, 7.0, and 8.3; sum of exchangeable bases was not equivalent to values for CEC by unbuffered salts. Standard deviations of the method were much lower than differences in CEC between methods. All soils showed less CEC with NH_4^+ or K^+ saturation compared to CA^{2+} or Na^+ saturation; difference is attributed to reaction with expanding phyllosilicates. For CEC measured at pH 7, component CEC of organic matter ranged from 40 to

180 between soil series, higher where free carbonate was present. Under same conditions, calculated CEC of clay ranged from 8 to 63 assuming negligible CEC of the silt component. Apparent pH-dependent CEC was attributed to hydroxyl-Al associated with organic matter and interlayering of expanding phyllosilicates. — GDC

Fiskell, John G. A. *See* Reneau, R. B., Jr. 07434

00280 **Flemal, Ronald C.** The attack on the Davisian system of geomorphology — A synopsis: Jour. Geol. Education, v. 19, no. 1, p. 3-13, 1971.

Most of the basic assumptions and details of W. M. Davis's system of the "Geographical Cycle" of geomorphological processes are currently being challenged and there is a growing consensus among geomorphologists that it may eventually be rejected. Alternatives to the concepts of grade, uplift, base level, and peneplane, as well as time concepts, have been offered, though not all have been accepted. Geomorphologists are divided into three camps: those who still adhere to Davisian concepts, those who replace them with a different cyclical erosional model, and those who reject them completely. — EH

Forbes, D. J. *See* Duguid, D. R. 00299

00217 **Forbes, Warren C.** Iron content of talc in the system $Mg_3Si_4O_{10}(OH)_2$-$Fe_3Si_4O_{10}(OH)_2$: Jour. Geology, v. 79, no. 1, p. 63-74, illus., table, 1971.

Experimental runs on the magnesian portion of the join talc-minnesotaite were made using the hematite-magnetite, nickel-nickel oxide, quartz-fayalite-magnetite, and magnetite-wustite-magnetite-iron buffers. The atomic Fe/(Fe + Mg) in the solid solution talc-minnesotaite increases with decreasing oxygen fugacity and with decreasing temperature. The upper stability limit of minnesotaite is about 270° on the QFM buffer and 300° on the MW-MI buffer. Talc probably coexists with quartz and an amphibole above those temperatures; the amphibole is cummingtonite on the HM, NNO, and QFM buffers, and anthophyllite on the MW-MI buffer. — *from* Author's abstract

Ford, D. C. *See* Goodchild, M. F. 00216

Formel'-Kortina, F. *See* Bugel'skiy, Yu. Yu. 07502

07241 **Forsten, Ann.** The Late Miocene Trail Creek mammalian fauna: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 39-51, illus., tables, 1970.

Voorhies (1965) described the Carnivora from Trail Creek, Wyo. Described here is the rest of the fauna, mostly teeth and jaws from the quarry northeast of Cheyenne. An open grassland habitat is indicated by most genera, but about a fifth of the individual specimens are immature, which makes difficult their identification and comparison with other known late Miocene assemblages. Only five of the approximately 20 different animal forms have been identified to species, in some cases only tentatively. The uncertainty is partly due to the confused state of taxonomy of some of the groups, such as dogs, horses, oreodonts, camels, and antelopes; local variation, it seems, has not been considered enough when new forms were described. The Trail Creek fauna resembles Barstovian faunas of the Great Basin rather than faunas of the plains, and, in absence of typical forest animals, those from Tonopah and Cedar Mtn. — GDC

Foster, Helen L. *See* Clark, Sandra H. B. 00293

00327 **Foth, Henry; Jacobs, Hyde S.** Field guide to soils — Earth Sci. Curriculum Proj. Pamph. Ser. PS-2: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 38 p., illus., tables, 1971.

The specific properties and appearance of a soil are determined by the kind of parent material and environment (climate, vegetation, and slope) under which the soil developed. These factors act over a period of time to transform soil material into soil

profiles. Similar soil profiles develop whenever similar combinations of these factors are found. For example, deep topsoils are characteristic of mature soils developed under grass. Forest soils characteristically have thin topsoils. Soils in humid regions usually contain little or no calcium carbonate, whereas soils in the subhumid and drier regions usually contain calcium carbonate. Instructions for studying a soil profile, and making a miniature soil profile are given. A study of soil pore space and water-holding capacity, as well as a percolation test, are included in a study of soil water. — ESL

07138 **Fox, Fred L.** Seismic geology of the eastern United States: Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 21-43, illus., 1970.

To provide a basis for studies for earthquake-resistant design, a correlation of seismicity with geology has been attempted in the United States east of the 90th meridian. The historical record, population density, geologic conditions, and location and construction of damaged structures have been considered. Using a Modified Mercalli Scale, earthquakes are related to major physiographic-tectonic provinces; in most cases seismic activity can be related to faulted areas, and postglacial rebound may be responsible for triggering shocks in some areas. A tentative seismic probability map, that illustrates the postulations made, may aid in determination of seismicity over broad areas and selection of design earthquakes. Microregionalization of particular areas can then be accomplished by detailed evaluation of local geologic conditions in order to anticipate probable effects of design earthquakes. — *from* Author's abstract

Fox, R. L. *See* Hasan, S. M. 07656

Foxworthy, B. L. *See* Cohen, Philip. 07488

Franke, O. L. *See* Cohen, Philip. 07488

Franklin, R. E. *See* Saxena, G. S. 07223

07626 **Franzmeier, D. P.** Particle size sorting of proglacial eolian materials: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 920-924, illus., tables, 1970.

In proglacial eolian deposits near the Wabash and White Rivers in southwestern Indiana [studied to test Bagnold's theory that there is a critical size separating particles moved by saltation from those carried by suspension], dune sand particles are predominantly larger than 80μ and loess particles are predominantly smaller than 40μ. In glacial till that is representative of the source material of the outwash, which, in turn, is the source of the eolian deposits, the 40-80μ fraction is very abundant. It appears that this fraction may have been preferentially removed during transportation and deposition of these eolian deposits. — Soil brief

00328 **Freeman, Tom.** Field guide to layered rocks — Earth Sci. Curriculum Proj. Pamph. Ser. PS-3: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 44 p., illus., 1971.

Discussion of the origin and features of rock layers includes the laws of horizontality and superposition, and definitions of beds and formations. Things to look for in selecting an outcrop for study should include: bedding and rock type, bedding planes and false layering, and limits of beds. Instructions for field projects are given for sketching the outcrop, measuring a section, relating grain size and currents, tracing rock beds and formations, illustrating thickness of a bed, and compiling a regional section. Questions to be answered after the field trip are included. — ESL

French, Robert R. *See* Carr, Donald D. 07529

Friedman, Irving. *See* Pearson, F. J., Jr. 07464

07607 **Friedman, Jules D.** The airborne infrared scanner as a geophysical research tool: Optical Spectra, v. 4, issue 6, p. 35-44, illus., table, 1970.

Airborne infrared imaging systems are effective in making thermal records of volcanic processes. Predictability of eruptions depends on detection of changes in the pattern of inter-eruptive heat flow. The airborne infrared scanner is ideal for reconnaissance exploration for geothermal areas. The practical threshold of detectability of anomalously high infrared radiation has been estimated to be equivalent to 200 to 700 μ cal/cm^2 sec convective heat transfer to the Earth's surface. Surveys in Iceland showed the value of concurrent airborne and electrical ground resistivity surveys. Resistivity lows indicating a source of hydrothermal fluids 650 m directly below the major infrared anomaly were found. A strong coincidence between location of microearthquakes and infrared anomalies was found also in Iceland. Infrared survey techniques also are suited to monitoring the environmental problem of thermal effluents. — ESL

00295 **Friedmann, Nadav; Miller, Stanley L.; Sanchez, Robert A.** Primitve earth synthesis of nicotinic acid derivatives: Science, v. 171, no. 3975, p. 1026-1027, table, 1971.

Nicotinonitrile, 2-cyanopyridine, and 4-cyanopyridine can be synthesized under primitive earth conditions by the action of electric discharges on ethylene and ammonia. The electric discharge first synthesizes pyridine and hydrogen cyanide, which react in the discharge to form the cyanopyridines. Nicotinonitrile would have hydrolyzed in the primitive ocean to nicotinamide and nicotinic acid. — Authors' abstract

Frishman, S. A. *See* Behrens, E. W. 00220

07159 **Fritts, Crawford E.** Geology and geochemistry of the Cosmos Hills, Ambler River and Shungnak quadrangles, Alaska: Alaska Div. Mines and Geology Geol. Rept. 39, 69 p., illus., table, geol. map, 1970.

Various summarized geologic data include minerals in the old Shungnak mining district, and geochemical analyses of stream sediments. An anticlinal Devonian-Cretaceous window is bounded by at least four thrust faults. Early Cretaceous granite intrusion, doming and folding, progressive metamorphism, and block faulting preceded thrust of three allochthons of metamorphosed pelitic, volcanic, and carbonate strata, including 2000 feet of fossiliferous Devonian limestone, over similar rocks of probable Devonian age. A fourth, of Cretaceous clastic rocks over the older strata, was latest, the faulting accompanied by Tertiary(,) ultramafic intrusion, serpentinization, and low-grade contact metamorphism. Placer gold, from quartz veins in Devonian strata near Cretaceous granite, and minor asbestos from serpentinite were mined formerly. Copper sulfides in Devonian dolomite breccia near Bornite, and nephrite from serpentinite boulders in old tailings are of current interest; origin of the copper is discussed briefly. — GDC

00205 **Fullagar, Paul D.; Lemmon, Robert E.; Ragland, Paul C.** Petrochemical and geochronological studies of plutonic rocks in the southern Appalachians — [Pt.] 1, The Salisbury Pluton: Geol. Soc. America Bull., v. 82, no. 2, p. 409-415, illus., tables, 1971.

The Salisbury pluton, composed chiefly of albite adamellite, is the most leucocratic and has the most anomalous trace element assemblage of 96 igneous bodies studied thus far in the Piedmont of the southeastern United States. Major element composition and textural evidence indicate that (1) the pluton originally underwent "eutectic point" crystallization in the system Ab-Or-An-Q-H_2O; and (2) extensive metasomatic alteration occurred near the end of crystallization. The whole-rock Rb-Sr isochron age is 411 $\pm$ 6 m.y. The initial Sr-87/Sr-86 ratio of 0.7032 $\pm$ 0.0010 indicates that the original magma from which the Salisbury magma fractionated was derived from the mantle and was not contaminated by older crustal rocks. — Author's abstract

07205 **Gabrysch, R. K.; McAdoo, Gene D.; Bonnet, C. W.** Records of water-level measurements in wells in Galveston County, Texas, 1894-1969: Texas Water Devel. Board Rept. 123, 100 p., illus., table, 1970.

The report consists of water-level measurements and a map showing location of observation wells. — MCM

07375 **Gaffney, Eugene Spencer.** The North American baenoid turtles and the cryptodirepleurodire dichotomy [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2155B, 1970.

07204 **Gage, Bard O.** Experimental dunes of the Texas coast: U.S. Army Corps Engineers Coastal Eng. Research Center Misc. Paper 1-70, 30 p., illus., table, 1970.

Storms and increased habitation on barrier islands have reduced the height and width of dunes on the Texas coast, exposing it to the surges and waves of tropical storms. Reported here are experimental means of creating and stabilizing dunes to protect the coast at four selected locations: the SW end of Galveston Island, Packery Channel, Newport Pass on North Padre Island and Corpus Christi Pass. Low areas of the barrier island were planted in various types of vegetative cover, without the aid of snow fences; snow fencing was used to accumulate windblown sand and vegetative planting made to stabilized dunes; junk cars were alined parallel to beaches and used instead of more conventional means to establish and stabilize dunes by trapping sand. Since snow fences are more effective and much cheaper, junk cars are not recommended for building dunes. — *from* Author's abstract

Galloway W. E. *See* Fisher, W. L. 07329

00235 **Galton, Peter M.** A primitive dome-headed dinosaur (Ornithischia — Pachycephalosauridae) from the Lower Cretaceous of England and the function of the dome of pachycephalosaurids: Jour. Paleontology, v. 45, no. 1, p. 40-47, illus., 1971.

A thickened skull cap from the Wealden (Lower Cretaceous) of the Isle of Wight is from a [new species of] very primitive pachycephalosaurid dinosaur. [Compared with North American Cretaceous ornithopods] the skull cap resembles that of hypsilophodontids more closely than that of *Stegoceras* in which one specimen has a low dome and a large supratemporal fenestra. The thick skull cap of pachycephalosaurids was probably used as a battering ram for intraspecific competition. — Author's abstract

Garrels, Robert M. *See* Wollast, Roland. 00260

07150 **Gartner, Stefan, Jr.** Coccolith age determinations Leg 5, Deep Sea Drilling Project, Chap. 19, *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 495-500, 1970.

Data presented represent coccolith age determinations made with a light microscope on sediment cores recovered in the Pacific Ocean during Leg 5 of the Project. Accuracy of age determinations differs between samples, depending on the number of diagnostic species. A species list by holes, including only those which aided in age determination, comprises most of the paper. — ESL

Gast, R. G. *See* Klobe, W. D. 07430

07397 **Gates, William G.** Geology and geological aids to production at the Heath Steele Mine [abs.]: Mining Eng., v. 22, no. 8, p. 37, 1970.

00332 **Geophysics Correspondent.** California quakes again: Nature, v. 229, no. 5286, p. 521-522, 1971.

Along the San Andreas fault and its parallel neighbors are regions of high seismicity interspersed with quiet zones in which strains may be building up to catastrophic quakes. The recent quake north of Los Angeles appears at first glance to fit neatly into this framework; yet it does not, and there is doubt among seismologists that it has done anything to relieve the accumulated strain. The motion was not on the San Andreas or San Gabriel faults, and it was not right-handed strike-slip. If a relatively unknown fault can suddenly break, then any reasonable effort at monitoring must be on a very broad and comprehensive (and long-term) basis. — Author's abstract

07504 **Gersper, P. L.; Holowaychuk, N.** Effects of stemflow water on a Miami soil under a beech tree — [Pt.] 1, Morphological and physical properties; [Pt.] 2, Chemical properties: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 779-794, illus., tables, 1970.

This *biohydrologic* factor in soil formation was investigated in 25 profiles around a beech tree on the Ohio State University farm in Franklin County, where glacial till is compact, medium textured, and high in $CaCO_3$. Stemflow effects on morphological properties of this soil were a thickening in the Al horizon, low-chrome mottling in the Bl horizon and increase in number of its subdivisions; and on physical properties, a lowered bulk density of the Al horizon, increasing clay content in the A horizon while that of the B2 horizon decreased, in reverse of their silt content. In a much wetter environment, caused by richer stem water, chemical analyses on samples at four distances in radial trenches, showed: in A horizons progressive increases toward the stem in organic C, total N, exchangeable acidity and K, CEC, and free Fe_2O_3; in B horizons progressive decreases in pH, exchangeable Ca, Mg and K, CEC, base saturation and free Fe_2O_3. — GDC

Giardini, A. A. *See* Salotti, C. A. 07522

Giblin, P. E. *See* Leahy, E. J. 00321

Gibson, James M. *See* Steineck, P. Lewis. 00210

07580 **Gibson, Richard Ernest.** A response spectrum solution for earthquake analysis of unsymmetrical multi-storied buildings [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1323B-1324B, 1970.

Giguere, J. F. *See* Leahy, E. J. 00321

Gill, Clark C. *See* Bonine, Michael E. 07191

07376 **Givens, Charles Ray.** Eocene molluscan biostratigraphy of the Pine Mountain area, Ventura County, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2156B, 1970.

Glancy, Patrick A. *See* VanDenburgh, A. S. 07514

07583 **Glaser, John Donald.** Nonmarine Cretaceous sedimentation in the middle Atlantic Coastal Plain [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1349B-1350B, 1970.

07558 **Glass, Gary B.** Limonite concretions in Clearfield County: Pennsylvania Geology, v. 1, no. 8, p. 8-9, illus., 1970.

This locality is in the northwest corner of the Houtzdale quadrangle, Clearfield County, Pa. Limonite occurs just above an abandoned back-filled strip mine as earthy to compact septarian concretions; siderite also is found in nodular and lenticular concretions which often contain sphalerite and quartz crystals. Bituminous coal is in nearly horizontal seams 24-54 inches thick at six levels in strip mines. Limonite has replaced nodules of freshwater limestones by weathering below coal seams. A fault trends northwest-southeast through the area, with the northeast side raised 60-100 feet. — ESL

Goldhaber, M. B. *See* Presley, B. J. 07152

Goll, R. *See* Olson, R. K. 07158

Goll, Robert M. *See* McManus, Dean A. 07143

07578 **Golparvar, Hassan.** Soil-ice properties of frost-susceptible soils, made hydrophobic [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1260B-1261B, 1970.

00216 **Goodchild, M. F.; Ford, D. C.** Analysis of scallop patterns by simulation under controlled conditions: Jour. Geology, v. 79, no. 1, p. 52-62, illus., tables, 1971.

Scallops produced in a flume by solution of plaster of paris under controlled conditions of water velocity and viscosity indicate that scallop length is inversely related to velocity and directly related to viscosity, but irregularities in mineralogy and physical structure of carbonate rocks modify these relations somewhat. — ETR

07634 **Goodman, George J.** Arthur Curtis Shead (1891-1968): Oklahoma Acad. Sci. Proc. 1968, v. 49, p. 226, 1970.

07173 **Goodman, James M.; Harrow, David R.** Micro-landscape models in geomorphic instruction: Oklahoma Acad. Sci. Proc. 1970, v. 50, p. 159-161, illus., 1970.

A field problem for use in advanced physical geography courses is described which requires an investigation area of limited size while preserving a totality in its systems-character and a variety of components or variables, in other words a micro-landscape. An example is given of a borrow pit on the shore of Lake Thunderbird in eastern Cleveland County, Oklahoma, which constitutes a micro-drainage basin. The basin was analyzed by students in terms of its geomorphic character. Each student designed his research program, developed his methods, and created his format for reporting results of the investigation. One group of papers was of a highly descriptive nature, the other a combination of description and analysis in which some quantitative techniques were applied. — EH

Goodman, Richard E. *See* Cruz, Rodolfo V. de la. 07450

Gordon, J. L. *See* Duguid, D. R. 00299

00313 **Gordon, Mackenzie, Jr.** Biostratigraphy and age of the Carboniferous formations, *in* Mississippian stratigraphy of the Diamond Peak area, Eureka County, Nevada: U.S. Geol. Survey Prof. Paper 661, p. 34-55, illus., tables, 1971.

The biostratigraphy of Early Mississippian to Middle Pennsylvanian formations of the Diamond Peak area is described. The sequence includes Joana Limestone, Chainman and Diamond Peak Formations, and Ely Limestone. The complex regional relations of Mississippian-earliest Pennsylvanian formations in the central Great Basin, Utah and Nevada are illustrated in a chart which emphasizes the extensive mid-Mississippian unconformity, disappearance of the Osage part of the Joana westward, lateral equivalence of Chainman Shale and much of Diamond Peak Formation, and the great range in age of Chainman Shale in various areas. The fauna is tabulated for the Diamond Peak Formation from members B-H of the Diamond Peak area and members B-D of Conical Hill, Eureka district, and for the Ely Limestone of the Diamond Peak area. A register of fossil collecting localities in the Diamond Peak area is included. — VSN

07403 **Gott, Garland B.** Zoning of major and minor metals in the Coeur d'Alene district, Idaho [abs.]: Mining Eng., v. 22, no. 9, p. 50, 1970.

07190 **Gould, Joseph C.; Langford, N. Gerald; Mott, Charles J.** Study guide for audio-tutorial earth science: Minneapolis, Minn., Burgess Publishing Co., 142 p., 1970.

This manual is designed as a study guide specifically for an audio-tutorial Earth Science program. It contains a study outline and related experiments and demonstrations. Instructional objectives for each unit are listed. Topics are covered in fourteen chapters which include three units on meteorology, seven on geology, and four on astronomy. — CJM

07215 **Grachev, A. F.; Dolukhanov, P. M.** PosleledniKovoye podnyatiye zemnoy kory v Kanade i v Fennoskandii po dannym radiouglerodnykh datirovok [Postglacial crustal uplift in Canada and Fennoscandia from radiocarbon dating (with English and German abs.)], *in* Baltica, V. 4: Vilnius, U.S.S.R., "Mintis," p. 297-312, illus., tables, 1970.

More then 400 C-14 datings, mostly of marine deposits, were used to plot curves of postglacial uplift in Canada and Fennoscandia. Analysis of curves indicates: Deglaciation of Fennoscandia took place between 13,000-9,500 yr B.P., in Canada

between 11,000-6,500 yr B.P., in Canada between 1,000-6,500 yr B.P. Maximum rate of postglacial uplift was reached about 9,500 yr B.P. in Canada (4.5 cm per yr) and 11,000 yr B.P. in Fennoscandia, about 2,000 yr after deglaciation began. Abrupt changes in uplift rates occurred in Canada about 7,500 yr B.P., and in Fennoscandia about 9,500 yr B.P. The earliest changes were in areas nearest the maximum ice-thickness. Uplift rates nearest to recent rates occurred in Canada about 2,500 yr B.P. and in Fennoscandia about 6,000 yr B.P. Deglaciation began in Canada about 18,000 B.P., in Europe about 22,000 yr B.P. — *from* Authors' abstract — EH

07367 **Grannell, Roswitha Barenberg.** Geological and geophysical studies of three Franciscan serpentinite bodies in the southern Santa Lucia Range, California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2069B-2070B, 1970.

07133 **Grant, C. L.** Sampling and preparation errors in trace analysis, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 216-225, tables, 1970.

The application of analytical methods to trace analysis requires evaluation of error sources. This paper considers selected problems of obtaining representative subsamples for trace analysis, changes that occur during sample storage, problems in evaluation of precision, accuracy evaluation, and separation of random and systematic error. Some important error sources — contamination during sampling, impure reagents, faulty techniques, etc. — have been thoroughly discussed elsewhere and are not discussed here. — VSN

07258 **Gray, Donald H.** Effects of forest clear-cutting on the stability of natural slopes: Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 45-66, illus., tables, 1970.

The evidence for a cause and effect relationship between deforestation and mass-soil movement is reviewed. Little-known work carried out by investigators in many parts of the world shows that forests play an important soil protective role and that deforestation or clear-cutting can promote not only soil erosion but also deep-seated slope failures. A forest cover appears to affect the deep-seated stability in two principal ways; viz., by modifying the hydrologic regime in the soil mantle and by mechanical reinforcement from its root system. A theoretical stability analysis is outlined in this paper which should make it possible to predict the stability of a forested slope and assess the probable consequences of denudation on a more rational basis. A field study presently being conducted in central Oregon is also described. Slopes have been instrumented there in order to obtain quantitative data on soil moisture stress and soil-mantle creep before and after clear-cutting. — Author's abstract

07567 **Gray, Richard E.** Landslides, *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 103-105, illus., 1970.

In western Pennsylvania three types of landslides are common: slumps, slow earth flows in soil, and rockfalls. Conditions causing each type are described, as well as localities where they have occurred. — EH

Gray, Richard E. *See* Heyman, Louis. 07568

07172 **Green, Donald E.** The idea of an inexhaustible supply of ground water on the Texas High Plains — The obstacle of a myth to water conservation: Oklahoma Acad. Sci. Proc. 1970, v. 50, p. 151-154, 1970.

An important obstacle to ground-water conservation on the Texas High Plains has been the erroneous belief that the regional underground water supply is inexhaustible. The myth had its origins in the 19th century theories that ground water beneath the Great Plains originated in the melting snows of the Rocky Mountains. Although early 20th century geologists pointed out that the underground water supply was simply the percolated accumulation of local rainfall, the populace adhered to the myth even after massive pumpage for irrigation had begun to lower the water table. In the late 1940's a High Plains organization, professing a belief in the myth, was lar-

gely responsible for defeat of a proposed water conservation law. — Author's abstract

07570 **Green, Jimmie Logan.** Phosphate fractions and their relation to the weathering and genesis of some soils of the Texas High Plains [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1007B-1008B, 1970.

07605 **Green, John C.** Lower Precambrian rocks of the Gabbro Lake quadrangle, northeastern Minnesota: Minnesota Geol. Survey Spec. Pub. Ser. SP-13, 96 p., illus., tables, geol. map, 1970.

Described here are the Ely Greenstone, 12,000 feet interbedded with cherty iron-formations; the Knife Lake Group, 5,000 feet of metasediments with felsic to intermediate pyroclastics; and above this 8,000 feet of similar volcanic strata with metabasalts and a thick lens of calcareous chert, the Newton Lake Group. Thick gneisses and schists faulted against lower Ely Greenstone are tentatively assigned to the Knife Lake Group. Intrusions include various porphyries, two granitic facies of the Giant Range batholith with local mafic variations, and ultramafic dikes. Vertical strata with local internal isoclinal folding, significant faults, and superimposed kink-folds are attributed to Algoman orogeny. Metamorphism of strata is generally low grade, amphibolitic near batholiths, and a narrow pyroxene hornfels next to the Duluth Complex. No economically viable iron-formations have been found, but sulfides in greenstones are being explored. — GDC

Green, R. E. *See* Corey, J. C. 07623

07648 **Greenman, L.** The grey breccia, host to the ore at Strathcona mine, Sudbury [abs.]: Geol. Soc. America Abs. with Programs, v. 2, no. 7, p. 561, 1970; Econ. Geology, v. 65, no. 6, p. 737, 1970.

07272 **Greiner, Gary Oliver George.** Environmental factors causing distributions of recent Foraminifera [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2763B, 1970.

00300 **Grice, R. H.** Geological data handling in urban areas [with French abs.]: Canadian Geotech. Jour., v. 8, no. 1, p. 134-138, illus., 1971.

A data handling system is being developed to facilitate the handling of engineering geology data collected by a number of independent observers in an urban area. The aim is to provide an economical mechanism for the preservation of a maximum amount of data which may be acquired by individual investigations and for selective retrieval and presentation of such data. — Author's abstract

00206 **Griffin, Villard S.** Fabric relationships across the Catoctin Mountain-Blue Ridge anticlinorium in Central Virginia: Geol. Soc. America Bull., v. 82, no. 2, p. 417-432, illus., table, 1971.

The northeast-trending anticlinorium is a coherent structure that is overturned northwestward. A macroscopic and microscopic study of planar and linear subfabrics across the anticlinorium suggests distinct differences in the kinematic history of the core and flanks of the anticlinorium. The Precambrian basement complex gneisses in the core are *a*-tectonites, recording extreme and penetrative cataclastic deformation. The Piedmont rocks on the southeastern limb are similarly deformed but show characteristics of both *a*- and *b*-tectonites. The Cambrian rocks on the northwest flank are *b*-tectonites that are less metamorphosed and less penetratively deformed. — RAL

00262 **Grimaldi, F. S.; Schnepfe, M. M.** Determination of iodine in p.p.m. range in rocks: Anal. Chim. Acta, v. 53, no. 1, p. 181-184, tables, 1971.

Previously known methods require that iodine be separated from the matrix to realize maximum sensitivity. The need for a simple method for determining iodine in geological material is growing in environmental studies. The procedure described

here provides for the presence of various forms of iodine, which are extracted into carbon tetrachloride and determined spectrophotometrically. At least 1 p.p.m. of iodine can be determined as a lower limit on a one-gram sample. — ESL

07655 **Groben, Mike.** Natrolite and analcime from Eckman Creek quarry, Waldport, Oregon: Mineralog. Rec., v. 1, no. 4, p. 153-173, 176, illus., 1970.

An occurrence of crystallized natrolite and analcime at the Eckman Creek quarry near Waldport, Lincoln County, Oregon, is described. In the quarry subaerial flows of columnar basalt of late Eocene age overlie pillow lavas in which zeolites were formed and crystallization occurred. The crystals of natrolite and analcime are described and are illustrated with photographs. — EH

07550 **Groller, Maurice J.** Geologic map of Apollo landing site 2 (Apollo 11) — Part of Sabine D region, southwestern Mare Tranquillitatis: U.S. Geol. Survey Misc. Geol. Inv. Map I-619 [ORB II-6 (25)], scale 1:25,000, separate text, 1970.

The separate text by N. J. Trask reviews geologic mapping of the Apollo sites; describes the crater, and mare and terra materials; and summarizes briefly other geologic units and structural and topographic features. The surface material at the spot where Apollo 11 touched down consists of fragmental material, generally fine grained but with abundant rocks up to 1 m in diameter. Preliminary examination of samples indicates a basaltic composition; several rocks have yielded ages of $3.0 \pm 0.7 \times 10^9$ yr by the K-Ar method. — MCM

07653 **Grubbs, Donald Keeble.** Weathering of diabase [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 1, p. 249B, 1970.

00237 **Guber, Albert L.** Problems of sexual dimorphism, population structure and taxonomy of the Ordovician genus *Tetradella* (Ostracoda): Jour. Paleontology, v. 45, no. 1, p. 6-22, illus., table, 1971.

Species of the ostracode genus *Tetradella* are unusual because they are shown to exhibit three types of shell dimorphism — histial, locular and domiciliar. A case is presented for the supravelar origin of the loculi. Preadult shell dimorphism, very rare in ostracodes, is present in *Tetradella*; hence, the living populations exhibited three distinct shell forms. Because the sex ratio of preadult shells shifts with ontogenetic stage, it is concluded that individuals began sexual differentiation at different ontogenetic stages. Adult tecnomorphs were probably scarce. Inferred phyletic relationships of all species are presented. Neotypes are designated for *T. quadrilirata* (Hall and Whitfield) and *T. lunatifera* (Ulrich). New species are *T. scotti*, Upper Ordovician, Ohio, and *T. buckensis*, Middle Ordovician, Ontario. — *from* Author's abstract

07534 **Guha, Shyamal K.; Stauder, William.** The effect of focal depth on the spectra of P waves — [Pt.] 2, Observational studies: Seismol. Soc. America Bull., v. 60, no. 5, p. 1457-1477, illus., tables, 1970.

Using the theoretical development of part 1, properties of transfer functions (radiation patterns) for P waves are investigated for different point sources as functions of depth of burial and orientation of the source in a layered crust. The calculated transfer functions, in general, exhibit two or more minima. These minima shift to longer periods as the source depth increases. The position and relative development ofthe minima are also functions of depth, of azimuth about the source, and of orientation of the source. In order to investigate whether the predicted effect of focal depth is identifiable in the amplitude spectra of recorded P waves, seismograms of four earthquakes are analyzed. It is found that some of the minima of the observed spectra are due to focal depth, and that for foci in the middle or lower crust, it is possible to determine the depth of focus of an earthquake from the positions of the minima in the spectra. — Authors' abstract

07289 **Guha, Shyamal Kanti.** The effect of focal depth on the spectrum of P waves [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2772B, 1970.

07620 **Güven, Necip.** Compositional and structural relationships between phengites and illites: Clays and Clay Minerals, v. 18, no. 4, p. 233-235, tables, 1970.

Illites, nonexpandable and generally 10A clay minerals, are more closely related in composition and environment to phengites, which occur in low-grade metamorphic rocks, than to muscovites, which occur in igneous or high-grade metamorphic rocks. Illites are diagenetic or detrital products in sedimentary rocks, sometimes deeply buried with greater pressure than temperature increase. Illites as well as phengites show several forms of polymorphism, while muscovite is almost invariably in the $2M_1$ form, from which structure of the too fine-grained illites has been inferred. In a table showing cation distributions in all three minerals, as well as stacking sequences, the amount of expandable interlayers in each illite is less than 10 percent. Structural effects of isomorphous substitutions along the muscovite-phengite join allow inferences to be made for illite structure and its polymorphism. — GDC

07468 **Guymon, G. L.; Scott, V. H.; Herrmann, L. R.** A general numerical solution to the two-dimensional diffusion-convection equation by the finite element method: Water Resources Research, v. 6, no. 6, p. 1611-1617, illus., 1970.

The two-dimensional diffusion-convection equation, together with the appropriate auxiliary conditions, is used to describe approximately the motion of dissolved constituents in porous media flow, dispersion of pollutants in streams and estuaries, energy transfer in reservoirs, and other natural transport processes. The two-dimensional diffusion-convection equation, with an assumed set of auxiliary conditions, is converted to a variational principle for systems that do not involve mixed partials. The variational principle is in turn solved by the Ritz procedure by dividing the domain of interest into an arbitrary number of finite triangular elements. Within each element the unknown function states are represented by a first order space polynomial. The resulting system of first order linear equations is then solved by numerical differentiation using the Adams-Moulton multistep predictor-corrector method. — Authors' abstract

07337 **Guzel, Nuri.** A pedogenic study of Malcolm, Morrill and Sharpsburg soils in southwestern Saunders County, Nebraska [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1648B, 1970.

07295 **Gwynn, John Wallace.** Instrumental analysis of tars and their correlations in oil-impregnated sandstone beds, Uintah and Grand Counties, Utah [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2857B, 1970.

07232 **Haas, John L., Jr.** An equation for the density of vapor-saturated NaCl-H_2O solutions from 75° to 325°C: Am. Jour. Sci., v. 269, no. 5, p. 489-493, illus., table, 1970.

Literature values of the density of vapor-saturated NaCl-H_2O solutions between 75° and 325°C and up to saturation or 7.3 molal, whichever is lower, were correlated by the use of the empirical Masson's Rule: $\phi=\phi^*+sm^{0.5}$, where ϕ is the apparent molal volume of NaCl, m is the concentration, $\phi^*=-167.219+448.55\ V_o-261.07\ V_o^2$, $s = (-13.644 + 13.97\ V_o) \times [V_r/(V_c - V_o)]^2$, and V_o and V_c are the specific volume and the critical volume of H_2O, respectively. The standard deviation between the calculated, densities and the source data is 0.002 g/cm³. — Author's abstract

00246 **Haas, Otto.** Inversion of ammonoid suture lines, — A reply: Jour. Paleontology, v. 45, no. 1, p. 141, 1971.

Schindewolf (1968) questioned Haas's (1941) observations on inversion of suture lines in *Hysteroceras varicosum* (Sow.), but Haas points out that the whorl fragment fits as oriented but could not if reversed. — JWH

07256 **Hadley, C. J.** Subsurface studies of reef debris will help reveal the presence and quality of pinnacle reefs in southwestern Ontario, Tech. Paper 8 *in* Ontario Petroleum Inst., 9th Ann. Conf., Ottawa, 1970: Chatham, Ontario, Ontario Petroleum Inst., 15 p., paged separately, illus., 1970.

The Pinnacle Reefs of southwestern Ontario that had their beginning in upper unit Guelph time can be shown to have had a number of interruptions to reef growth, with coincident erosion and production of reef debris. Use of gamma logs in conjunction with careful interpretation of sample and core evidence will enable the worker to map various zones of debris. Contoured patterns of debris can be used unsuccessfully to predict the presence and possibly the quality of Pinnacle Reef Reservoir. The presence of debris will indicate the most prospective areas for running seismic tests. Seismic lines should be run to best accommodate the interpreted pattern of debris deposition. — *from* Author's conclusions

07135 **Hafner, S. S.** Order-disorder studies in silicates by means of gamma-ray resonant absorption of ^{57}Fe, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 292-299, illus., tables, 1970.

The occupancy of Fe^{+2} at the nonequivalent octahedral sites in pyroxenes (chain silicates) has been determined from ^{57}Fe resonant absorption spectra. The accuracy of the occupancy numbers is better than 0.02. The nuclear quadrupole splittings and isomer shifts are not affected by the degree of Fe^{+2} disorder. Therefore, the intensities of the doublets yield intrinsic values, independent of short-range order effects. Employing simple thermodynamical considerations, conclusions can be made on Fe^{+2} equilibrium distribution constants, free Gibbs energy differences for the F^{+2} exchange reactions, activation energies for ordering and disordering, etc. — Author's abstract

00333 **Hager, Michael W.** Fossils of Wyoming: Wyoming Geol. Survey Bull. 54, 51 p., illus., 1970 [1971].

This booklet was prepared to help amateur collectors identify the common fossils of Wyoming (and a few rare ones of particular interest), as to phylum or general type; references are listed for use in more precise identification. Following a brief geologic history of Wyoming from Precambrian to Quaternary time, the highest taxonomic divisions of invertebrates, vertebrates, and plants are briefly noted, and representative fossil forms from Wyoming are illustrated. Generic name, period or epoch, stratigraphic range in Wyoming, and size or scale are given for most of the specimens illustrated. — VMJ

07652 **Hagerty, Royal Moncrief.** Clay mineralogy of the southwestern Gulf of Mexico and adjacent river outlets [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 1, p. 274B, 1970.

07505 **Haimson, B.; Fairhurst, C.** In-situ stress determination at great depth by means of hydraulic fracturing, Chap. 28 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 559-584, illus., tables, 1970.

Results are reported on a theoretical and experimental study of the method of hydraulic fracturing as an instrument for determining regional tectonic stresses at great depth. The existing criteria for hydraulic fracturing initiation was extended to the case in which injected fluid actually penetrates into the porous rock surrounding the borehole. A main disadvantage is that two additional parameters of the porous-elastic rock are needed in relating breakdown pressure to principal tectonic stresses. Using rubber packers, and provided the pressurized borehole is not precracked, the complete tectonic state of stress can be determined in both permeable and impermeable formations. Laboratory tests on simulated boreholes in both rock types resulted in tensile ruptures, but in field tests with rubber packers, only vertical fractures were obtained. Some results from oil fields in Ohio and Illinois are cited. — VSN

07313 **Halbouty, Michel T.** The exploration geologist in the seventies, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 1-4, 1970.

This is the keynote address presented before the 1970 Annual Convention of the Gulf Coast Association of Geological Societies. The seventies promise to be a period of turmoil and change for the petroleum industry throughout the world. Geologists must make technology compatible with the environment. Current exploration methods will not be adequate to find the needed large new domestic reserves; petroleum geologists must determine whether they, individually and as a group, are traveling in the right exploratory directions. The geologic profession as a whole must start looking purposefully for the hidden and subtle stratigraphic and paleogeomorphic traps, using all known disciplines and, in particular, the geological mind to determine indications initiating and leading to discovery of such traps. — DBV

07265 **Hamel, James Victor.** Stability of slopes in soft, altered rocks [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2664B, 1970.

07515 **Hamilton, Edwin L.** Reflection coefficients and bottom losses at normal incidence computed from Pacific sediment properties: Geophysics, v. 35, no. 6, p. 995-1004, illus., tables, 1970.

Rayleigh reflection coefficients and bottom losses of compressional waves at normal incidence on the water-sediment inferface are computed with values of density and velocity measured in sea-floor sediment samples; main sediment types in three major environments of the Pacific and adjacent areas are included. Some typical average computed values of acoustic bottom loss at normal incidence in db are (1) continental shelf: sands, 8; silty sand, 10; sandy silt, 14; silty clay, 16; (2) abyssal plain: clayey silt, 17; silty clay and clay, 21: and (3) abyssal hill: silty clay and clay, 17. Comparisons with actual measurements at sea by several investigators demonstrate the validity of the approach. — Author's abstract

Hamilton, M. *See* Nishita, H. 07230

Hamza, V. M. *See* Verma, R. K. 07309

07353 **Handfield, Robert Charles.** Archaeocyatha from the Mackenzie and Cassiar Mountains, western Canada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2063B, 1970.

07617 **Hang, Pham Thi; Brindley, G. W.** Methylene blue absorption by clay minerals — Determination of surface areas and cation exchange capacities (Clay-Organic Studies XVIII) [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 4, p. 203-212, illus., tables, 1970.

Under appropriate conditions, both surface areas and cation exchange capacities of clay minerals can be measured by absorption of methylene blue from aqueous solutions. The method has been applied to two kaolinites, one illite, and one montmorillonite, all saturated with Na^+ ions. For Na-montmorillonite, the total area, internal plus external, is measured. For Ca-montmorillonite, entry of methylene blue molecules appears to be restricted by the much smaller expansion of the Ca-clay in water. X-ray diffraction data clarify the absorption behavior in Na- and Ca-montmorillonite, and in particular it is shown that two orientations of the methylene blue molecules are involved. — Authors' abstract

07402 **Hansuld, John A.** Geochemical surface halos — Tri-state district [abs.]: Mining Eng., v. 22, no. 9, p. 50, 1970.

07451 **Hardy, H. R., Jr.; Kim, R. Y.; Stefanko, R.; Wang, Y. J.** Creep and microseismic activity in geologic materials, Chap. 21 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 377-413, illus., tables, 1970.

Data from an experimental, simultaneous study on microseismic activity and inelastic behavior of sandstone, limestone, and granite under uniaxial compression reveal that

axial and transverse creep strain vs. time data in most cases fit the form of the generalized Burgers model for n = 2, consisting of two Kelvin-Voigt units and a single Maxwell unit in series. Inelastic parameters associated with axial data are presented in tables; a number are stress-dependent. Considerable time-dependent dilatation was observed for all rock types at stress levels about 40-70 percent of mean compressive strength; dilatation vs. time data also fit the n = 2 form. Accumulated microseismic activity vs. time data in most experiments fit a mathematical expression similar to that of n = 2, strongly suggesting correlation between creep strain and microseismic activity. — VSN

07317 **Harris, John F.** The search for the subtle clue, carbonate exploration in the Seventies, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 89, 1970.

Exploration for carbonate reservoirs in the next decade will necessitate knowledge of depositional, diagenetic, and epigenetic processes influencing porosity origins and characteristics. These processes often leave only subtle clues to their presence in the surrounding less altered nonporous sediments. Reservoirs with porosity structurally controlled by fracturing and alteration have been drilled or produced in carbonate sections throughout the world, but often these porosities have been lumped in with those of depositional origin. — DBV

Harris, R. Merrill. *See* Lynch, W. D. 00265

Harrow, David R. *See* Goodman, James M. 07173

07410 **Harvey, Edward J.; Skelton, John.** An evaluation of anomalous streamflow patterns by seepage runs and radar imagery in the Missouri Ozarks [abs.]: Mining Eng., v. 22, no. 9, p. 54, 1970.

Harward, M. E. *See* Carstea, D. D. 07618

07656 **Hasan, S. M.; Fox, R. L.; Boyd, C. C.** Solubility and availability of sorbed sulfate in Hawaiian soils: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 897-901, illus., tables, 1970.

Adsorbed sulfate in volcanic ash soils is related to rainfall. Highly weathered and leached subsoils may contain 7,000 μg SO_4-S/g soil. Some of the less weathered ash soils are almost devoid of sulfates. Adsorption maxima for several surface soils developed from volcanic ash ranged from 80 to 1,500 μg S/g. These soils represented a rainfall variable of 200 to 4,500 mm. Soils with large amounts of adsorbed sulfate should contain about 5 ppm S in solution for adequate nutrition of kikuyu grass in pots. A soil which was very sulfur deficient in the field was only 10 percent sulfate saturated. — Soil brief

Hatcher, J. T. *See* McNeal, B. L. 07229

Hatcher, J. T. *See* Rhoades, J. D. 07628

Haven, R. G. *See* Myers, A. T. 07259

07463 **Hay, William W.; Wise, Sherwood W., Jr.; Stieglitz, Ronald D.** Scanning electron microscope study of fine grain size biogenic carbonate particles, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 287-302, illus., 1970.

Possible applications of scanning electron microscopy to the study of Recent carbonate sediments have been explored, using artificially prepared samples. Ultrastructural patterns characteristic of particular organisms are easily recognizable on isolated grains of fine sand size and in some silt-size grains as small as 4μ in diameter. Biogenic silt-size particles only a few microns thick can be distinguished from inorganic calcium carbonate. If ultrastructural patterns are not visible on the surfaces, grains can be embedded in epoxy resin, polished, and etched to display relict struc-

ture. Criteria for recognizing skeletal ultrastructures will be refined as more known taxa are described by scanning electron microscope techniques. — DBV

07666 **Hayes, John B.** Polytypism of chlorite in sedimentary rocks [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 5, p. 285-306, illus., tables, 1970.

Added to four chlorite polytypes X-ray identified in clay-soils and sedimentary rocks, type-Ib_a is herein defined as disordered chlorite which lacks an *h*O*l* diffraction band in the 2.4-2.5 A region. Mostly authigenic, type-I chlorites form during diagenesis or halmyrolysis at temperatures and pressures less than low-grade metamorphism necessary to convert I*b* to II*b*; a crystallization sequence is proposed. Chemical composition has little or no effect upon polytype relative stabilities. Source areas with II*b*-chlorite-bearing metamorphic rocks can yield essentially unweathered detrital II*b* chlorite; but, in unmetamorphosed sedimentary rocks, because II*b* is the most stable polytype, it may form authigenically at submetamorphic temperatures. Chlorite polytypism can be applied as a geothermometer to recognize authigenic versus detrital origin of clay minerals, particularly in graywacke matrix; diagenetic facies or gradients; hydrothermal and incipient metamorphic effects. — GDC

07218 **Hearst, Joseph R.; Carlson, Richard C.; Rambo, John T.** K-division experimental work — Pt. 1, Geophysical research for underground explosion technology — Univ. California Livermore, Lawrence Radiation Lab. UCRL-50855: Springfield, Va., Natl. Tech. Inf. Center, 172 p., illus., tables, 1970.

This report is a detailed discussion of all the research carried out by the Geophysics Research Group [Lawrence Radiation Lab.] during the past four years. It updates material that has already been published elsewhere. Descriptions are given of tests of a dry hole acoustic log, a shear-wave downhole survey, and comparisons between commercial logging systems and other logging methods. Computer programs for reducing logging data to physical properties are also discussed, as are programs for correlation and storage of logs. A proposed new method for measuring shear strength in place is also discussed. — Authors' abstract

Heck, David B. *See* Shimp, Neil F. 00279

Heck, David B. *See* Schleicher, John A. 07250

Hedge, Carl E. *See* Peterman, Zell E. 00199

07201 **Heindl, L. A.** The water we live by — How to manage it wisely: New York, N.Y., Coward-McCann, 127 p., illus., 1970.

Most wasteful water uses would be little objected to if water were not limited, but only 3 percent of water covering three-fourths of Earth is fresh, four-fifths of that is locked up in ice caps; about five-eighths of 1 percent of the total fresh supply is available; 95 percent of it is in the ground, hard to reach, and slow moving. Stream water, replenished over and over in hydrologic cycle, is recirculated about 25 times a year; 95 percent runs off to oceans. About 420 cu mi per yr represents 6500 gals per day for each of 200,000,000 people in the United States, one fourth of it now being used. Management must cope with quality, salt, silt and pollution; climatic floods and droughts; landscape changes due to crustal movements, erosion, subsidence, and volcanic eruptions. With man-made changes for specific short-term benefits, adverse irreversible side effects could appear long afterward. — GDC

Heinrich, E. William. *See* Salotti, C. A. 07522

07663 **Henderson, G. V.** The origin of pyrophyllite-rectorite in shales of north central Utah [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 5, p. 239-246, illus., tables, 1970.

Pyrophyllite is widespread in pelitic rocks of the Manning Canyon Shale in north central Utah, and the association of this mineral with other clay minerals, especially

rectorite, is related to the origin. The regular mixed-layer clay mineral rectorite seems to form as a result of the alteration of muscovite-paragonite during late stages of diagenesis and represents an intermediate metastable phase in the mineral paragenetic sequence. Pyrophyllite subsequently formed from the alteration of rectorite during advancing metamorphism and is the stable end member of the clay mineral assemblage. Structural interpretation of rectorite found in the Manning Canyon Shale shows a regular, alternating sequence which consists of a fixed layer of 9.6 A and an expandable layer varying from 10 A to 17 A. With ethylene glycol saturation in the natural state a basal reflection of 26.60 A is recorded. — Author's abstract

07194 **Henderson, J. F.** (compiler). Current research in the geological sciences in Canada 1969-70: Canada Geol. Survey Paper 70-5, 250 p., 1970.

Research projects listed (some annotated) have been obtained mainly from universities, federal and provincial departments of mines and other nonindustrial institutions carrying on research in the geological sciences; in general research by oil and mining company geologists is not included. Fields covered are: areal geology; data storage, retrieval and manipulation; engineering geology; geochemistry; geochronology; geomorphology and glaciology; geophysics; mineral deposits; mineralogy; paleontology; petrology and petrography; Quaternary geology and ground water; sedimentology and sedimentary petrology; stratigraphy and paleontology; structural geology and tectonics. An author index and a list of organizations reporting are included. — MCM

Hensel, D. R. *See* Volk, G. M. 07226

07526 **Herbert, T. A.; Wingard, N. E.** Evaluation of three gravel sampling methods, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 95-102, illus., tables, 1970.

Three sampling methods — auger boring, used extensively for soil sampling but usually for qualitative information only; channeling, accepted, but usually limited to fresh excavations and generally cumbersome; and grab sampling, for both sedimentary and hard rock, but not widely accepted in the gravel industry for commercial evaluation — are compared on the basis of their ability to detect natural variations within a gravel deposit. Thirty-two uncased auger, 14 channel, and 128 grab samples from a small area in one gravel pit were examined on the basis of size-frequency distributions for each sample to compare methods and assign confidence levels. An analysis of variance established that auger boring is sufficiently representative where sizes below one inch are considered, and where lift recovery method is used; grab samples provide a representative sample where bank exposures are available, and all particle sizes are considered; channel samples were found less reliable. — *from* Authors' abstract

07527 **Herdendorf, Charles E.; Braidech, Lawrence L.** A study of the sand and gravel deposits of the Maumee River estuary, Ohio, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 103-116, illus., tables, 1970.

Thirty test borings were made in river-bed sediments of the Maumee River estuary by the hydraulic jetting method and cores were taken with a hand-driven check-value sampler; samples were mechanically analyzed for grain size by hydrometer and sieve methods. Surface samples consisted of 21 percent silt and clay-sized particles, 54 percent sand, and 25 percent gravel. Subsurface samples from the northern section and from areas nearest the banks contained more silty material than did those from other areas. Best graded sand for concrete aggregate was in midstream deposits adjacent to Delaware and Clark Islands. Records from a water-leveling gage indicated the lower Maumee River is an estuary of Lake Erie, with its level controlled by the lake. During the period 1948-69, an average of slightly less than 150,000 cu yd of material per year was removed from the estuary, indicating a 110-yr reserve is available. — *from* Authors' abstract

Herrmann, L. R. *See* Guymon, G. L. 07468

07611 **Hertlein, Leo G.** A new species of fossil *Kelletia* (Mollusca: Gastropoda) from the Lomita Marl, late Cenozoic of San Pedro, California: Los Angeles County Mus. Contr. Sci., no. 190, 8 p., illus., 1970.

Kelletia kanakoffi, n.sp., of the family Neptuneidae, is described from the Lomita Marl, basal member of the San Pedro Formation, of late Pliocene or very early Pleistocene age, in San Pedro, Calif. The new species differs from the living *K. kelletii*, the Pliocene *K. vladimiri*, and other western North American species of the genus, in its larger size, thick shell, coarse spiral sculpture, and large umbilicus. — *from* Author's abstract

07134 **Herzenberg, C. L.; Riley, D. L.** Current applications of Mössbauer spectrometry in geochemistry, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 277-291, illus., tables, 1970.

Mössbauer spectrometry is presently in use as an analytic technique in geochemistry. It has been used to study the structure of minerals and to identify the mineral phases present in multiphase mineral aggregates, such as rocks, sediments, and soils. The success of these applications suggests that Mössbauer spectrometry will become a standard instrumental technique in determinative mineralogy. The measurement and analysis of geochemical rock standards and ocean sediments will be described and our results correlated with those previously obtained using conventional analytic methods. Other topics will include the use of Mössbauer spectrometry to identify igneous rocks and to study ultrafine-grained and colloidal sediment materials. — Authors' abstract

07399 **Hewitt, William Paxton.** San Carlos lead deposit, northeast Chihuahua, Mexico [abs.]: Mining Eng., v. 22, no. 8, p. 37, 1970.

07202 **Heyl, A. V.; Broughton, W. A.; West, W. S.** Guidebook to the Upper Mississippi Valley base-metal district (prepared for the Geol. Soc. America Ann. Mtg., Milwaukee, Wis., 1970): Wisconsin Geol. and Nat. History Survey Inf. Circ. 16, 49 p., illus., table, 1970.

In this zinc-lead district in the Driftless Area of Wisconsin and adjacent Iowa and Illinois, ores are chiefly in Ordovician limestones and dolomites, and locally in Upper Cambrian sandstones with small sulfide deposits in Silurian formations. Precambrian basement rocks are at depths of 1500 to 2000 feet; no post-Precambrian igneous rocks are known. This paper reviews the geologic history and stratigraphy, structure, age of mineralization, and various features of the ore deposits; not cited are a short section by Broughton on History and production, and one by West, "Characteristics of dolomitized Platteville and Decorah Formations in the eastern part of the district, differing from western facies." The authors favor ore deposition by hydrothermal solutions, probably a mixture of heated connate waters and a small fraction of magmatic waters, later diluted by meteoric waters. — GDC

07470 **Heyl, Allen V.; Jolly, Janice L.** Mineralogy, trace elements and sequence of deposition in the central Tennessee district [abs.]: Mining Eng., v. 22, no. 9, p. 50, 1970.

Heyman, Louis. *See* Cate, Addison S. 07561

07565 **Heyman, Louis.** History of Pittsburgh's rivers, [Chap.] 7 *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 84-92, illus., 1970.

The Appalachian plateau of western Pennsylvania is drained by two major river systems, the Susquehanna River drainage in the eastern part of the plateau and the Ohio River in the western part. The history of the rivers since the early part of the Cenozoic Era is described. The Illinoian glaciers, although they did not reach the Pittsburgh area, caused the rivers to change their courses to a southerly direction. The Wisconsin glaciers created only local changes in the drainage system by deposition by melt waters, but deposited the gravelly alluvium which is the primary source of ground water for Allegheny County. River terraces and channels are described. — EH

07568 **Heyman, Louis; Gray, Richard E.; Wagner, W. R.; Edgerton, Curtis D.** Economic geology, [Chap.] 9 *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 105-127, illus., 1970.

The introduction to this chapter reviews commercially valuable mineral materials in the Pittsburgh area and gives the historical background of the development of the coal industry in Allegheny County and vicinity. Separate sections cover coal, mine subsidence, petroleum and natural gas, surface and ground water, sand and gravel, sandstone and limestone, and clay and shale. Occurrence of each commodity, mines and quarries, production and uses are given. — EH

Hiatt, John L. *See* Odom, I. Edgar. 07521

07641 **Hibbard, Claude W.** A new microtine rodent from the upper Pliocene of Kansas: Michigan Univ. Mus. Paleontology Contr., v. 23, no. 7, p. 99-103, illus., 1970.

A new species of the small microtine rodent, *Nebraskomys*, from the upper Pliocene Rexroad fauna is described. It is considered as ancestral to *Nebraskomys mcgrewi* Hibbard from the Pleistocene Sand Draw local fauna of Nebraska. *N. mcgrewi* is considered as the ancestral stock that gave rise to *Atopomys texensis* Patton from the later Pleistocene of Texas. — Author's abstract

07166 **Hill, F. L.** Rice Creek gas field: California Oil Fields — Summ. Operations 1970, v. 56, no. 1. p. 39-43, illus., tables, 1970.

The deepest well in the Rice Creek field (northern Sacramento Valley) was drilled to a depth of 12,174 feet, reaching the Venado Formation (Upper Cretaceous). The field is at the southern end of the Corning anticline. Lenticularity of the sands is the principal factor controlling accumulation. Cumulative production is over 10 million Mcf. — MCM

00223 **Hill, Mason L.** A test of the new global tectonics — Comparisons of northeast Pacific and California structures: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 3-9, illus., 1971.

Tectonic patterns and histories of these regions appear to be essentially unrelated as indicated by: (1) Contrasting E-W crustal shortening patterns purported to result from telescoping of American and Pacific plates and the patterns evidenced by San Andreas fault; (2) apparent lack of oceanic structures in the continental crust and vice versa; and (3) lack of evidence that the San Andreas fault is a transform fault or that it separates two major crustal plates. — EGS

07409 **Hill, Ronald D.; Wilmoth, Roger C.** Limestone treatment of acid mine drainage [abs.]: Mining Eng., v. 22, no. 9, p. 53, 1970.

07354 **Hiltabrand, Robert Ray.** Experimental diagenesis of argillaceous sediment [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2063B, 1970.

Hilts, D. E. *See* Miller, R. P. 07441

07501 **Hine, George T.** Relation of fracture traces, joints, and ground-water occurrence in the area of the Bryantsville quadrangle, central Kentucky: Kentucky Geol. Survey, ser. 10, Thesis Ser. 3, 27 p., illus., 1970.

Fracture traces (natural linear features visible on aerial photographs), joints, and ground-water occurrences were studied in detail in a limestone area of approximately 48 square miles in the Inner Blue Grass region of Kentucky. Twenty-four hundred fracture traces, several hundred joints, and numerous wells and springs were related. Fracture traces exhibit orientation patterns similar to joint patterns and form as the result of the enlargement of joints by ground-water solution. Springs usually occur along fracture traces, and wells drilled near fracture traces encounter solution openings at depth. Most subsurface water movement in the area is probably along vertical fractures, either joints or faults. — Author's abstract

Hinze, W. J. *See* Meshref, W. M. 07185

Hirschfeld, R. C. *See* Einstein, H. H. 07439

Hoagland, Alan D. *See* Fisher, Frederick T. 07396

Hodge, Dennis S. *See* Smith, Bruce D. 07240

07584 **Hodgson, Edward Askew.** Petrogenesis of the Lower Devonian Oriskany Sandstone and its correlates in New York, with a note on their acritarchs [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1350B, 1970.

07421 **Hodgson, J. F.** Chemistry of trace elements in soils with reference to trace element concentration in plants, *in* Trace substances in environmental health III — Conf. on Trace Substances in Environmental Health, 3d Ann., Columbia, Mo., 1969, Proc.: Columbia, Mo., Univ. Missouri, p. 45-58, illus., tables, 1970.

Principal factors at work promoting differences in elemental composition of rocks, soils, plants, and animals are discussed. Differences arise principally from leaching or particle-size sorting. Topics covered are: relative importance of various environmental factors to plant composition, dependence of plant composition on rock composition, effect of soil-forming processes, change in composition with availability of an element, and effect of plant response. — ESL

Hoffman, Buren W. *See* Kuykendall, W. E., Jr. 07148

07192 **Hogan, Edward Patrick; Opheim, Lee A.; Zieske, Scott H.** Atlas of South Dakota: Dubuque, Iowa, Kendall/Hunt Publishing Co., 137 p., illus., 1970.

Of the 68 maps in this quarto-sized atlas, those of geologic interest are on soil parent materials; coal resources; oil fields and major structural features; gold, silver, uranium and iron-ore deposits; lead, zinc and manganese resources; tin and molybdenum; sand and gravel deposits; clay resources; and salt and brine locations. — MCM

Holland, Warren E. *See* Robinson, Leon H. 07457

07355 **Hollister, Charles Davis.** Sediment distribution and deep circulation in the western North Atlantic [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2063B-2064B, 1970.

Holowaychuk, N. *See* Gersper, P. L. 07504

Holt, R. F. *See* Latterell, J. J. 00316

Holz, Robert K. *See* Bonine, Michael E. 07191

07474 **Hoover, Karl V.** (editor). Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), 278 p., illus., tables, 1970.

The forum consists of 14 papers (cited separately) and a panel discussion on industrial mineral, land use, and conservation problems. — MCM

07370 **Hornberger, George Milton.** Numerical studies of composite soil-moisture groundwater systems [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2099B, 1970.

07214 **Hornbogen, Erhard; Kreye, Heinrich.** The microstructure of two iron meteorites [with German abs.]: Zeitschr. Metallkunde, v. 61, no. 12, p. 914-923, illus., 1970.

Two iron meteorites (Coahuila, Gibeon) have been investigated by light- and transmission-electron microscopy and with the microprobe. The alloying elements important for the solid state reactions are phosphorus and nickel respectively. A complete description of the microstructure is given, including the lattice defects. The evaluation of the thermo-mechanical history indicates the following sequence of events in both meteorites: slow rate of cooling, plastic deformation at elevated temperature,

higher rate of cooling, second plastic deformation by impact below 300°C. The results are compared with the present opinions on the origin of meteorites. — Authors' abstract

Hoskins, Earl R. *See* Russell, James E. 07444

07356 **Hounslow, Arthur William.** Crystal structures of two naturally occurring chlorapatites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2064B, 1970.

07465 **Howard, Alan D.; Keetch, Mary E.; Vincent, C. Linwood.** Topological and geometrical properties of braided streams: Water Resources Research, v. 6, no. 6, p. 1674-1688, illus., tables, 1970.

Strong relationships among dimensionless properties of braided streams indicate that similarity is preserved in streams with the same average number of channels but of different sizes. The degree of braiding in streams, conveniently measured by the average number of channels bisected by lines crossing the channels, increases with the product of discharge and gradient, but decreases with higher variance in discharge. A random walk simulation model of braiding duplicates many of the numerical relationships observed in natural streams, suggesting that most of the downstream variation in the number of channels in braided streams is explainable by local fluctuations in discharge and sediment in transport, as opposed to large-scale factors such as valley constriction. — Authors' abstract

07219 **Howard, Barry C.** A computer code for the analysis of digitized seismic signals — Univ. California Livermore, Lawrence Radiation Lab. UCRL-50939: Springfield, Va., Natl. Tech. Inf. Center, 45 p., illus., tables, 1970.

The ADSS code, a multipurpose tool for the reduction of digitized seismic signal data, is presented. The 48 major functions of the code, subroutines identified and called by number, are described. A sample application of the program to digitized seismic data is included. This paper can serve both as an introduction and as a reference manual for the ADSS code. — Author's abstract

07585 **Howe, Dennis Milton.** Post-Casper-Ingleside unconformity and related sediments of southeastern Wyoming and northcentral Colorado [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1350B-1351B, 1970.

00302 **Howell, David G.** A stromatolite from the Proterozoic Pahrump Group, eastern California: Jour. Paleontology, v. 45, no. 1, p. 48-51, illus., 1971.

This paper describes a stromatolite from the Crystal Spring Formation, Pahrump Group [northeastern San Bernardino County], California, which strongly resembles stromatolites of the genera *Baicalia* Krylov and *Jacutophyton* Shapovalova found in the Precambrian of the USSR. *Baicalia* ranges in age from lower Upper Riphean to middle Lower Riphean (0.9-1.3 aeons). *Jacutophyton* has been found only in the middle Riphean (ca. 1.1 aeons). The inferred age of the Crystal Spring stromatolite is between 0.6 and 1.7 aeons, possibly older than 1.2 aeons. It is therefore similar in both morphology and age to the aforementioned Russian genera. — Author's abstract

07448 **Hoyaux, B.; Ladanyi, B.** Rock failure around a circular opening in a gravity field with tectonic forces , Chap. 17 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 281-292, illus., 1970.

The stability of an underground opening depends on the shape, extent, and location of failed regions, which are called 'plastic zones.' The development of plastic zones is understood in the case of circular openings in an elastic ideally plastic medium subjected to a nongravitational stress field but not for extent of such zones in a more general case and for rocklike media. A mathematical solution is given here that is

valid for a horizontal tunnel of circular cross section through a rock medium at finite depth, assuming (1) a gravitational stress field and (2) a gravitational stress field with superimposed varying horizontal tectonic stress field. — VSN

00253 **Hoyt, John H.** Field guide to beaches — Earth Sci. Curriculum Proj. Pamph. Ser. PS-7: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 46 p., illus., 1971.

A description of tsunamis opens the guide. Parts of beaches are named and described, and their relation to waves discussed. Tides; swash, backwash, and longshore current; and rip currents and undertow, and their effect on beaches, are described. Dunes are found landward from sand beaches, and are eroded on the seaward side during storms; dunes protect the mainland. Most beaches on the Atlantic and Gulf Coasts are on barrier islands, which were dunes at a lower sea level. Preparation for field study and equipment needed are described; the size of waves and direction of their approach to the beach should be determined, sand movement studied, and measurements of longshore current and tides should be included. The beach profile can be determined by using the profiler made in preparation for the trip. Beach sediments, layering, and other beach features should be examined; some laboratory studies are suggested. — ESL

07274 **Huang, Ter-Chien.** The sediments and sedimentary processes of the eastern Mississippi Cone, Gulf of Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2764B-2765B, 1970.

07275 **Huang, Wen Hsing.** Experimental studies of kinetics and mechanisms of simulated organo-chemical weathering of silicate minerals [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2765B, 1970.

07483 **Hudec, Peter P.** Long range planning for aggregate materials in Metropolitan New York, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 165-177, illus., tables, 1970.

About 9-13 million tons of sand and gravel are produced annually in Nassau and Suffolk Counties, L.I., with about half going into New York City markets. Present reserves are about 162 million tons, but estimated needs for the city and the two counties to the year 2000 are 700 million tons. The pressure of suburban expansion and increasingly restrictive zoning threatens to cut off the supply, and the construction industry will be forced to import materials or use less desirable stone from outside sources at a considerable increase in cost. A choice of possible zoning ordinances and conditions under which operators would be permitted to produce sand and gravel to benefit operators, local residents, the city, and the two counties, and ultimately the residents of the whole metropolitan region is proposed. — *from* Author's abstract

Hulbert, L. C. *See* Alizai, Hamid Ullah. 07225

07293 **Huntoon, Peter Wesley.** The hydro-mechanics of the ground water system in the southern portion of the Kaibab Plateau, Arizona [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2802B, 1970.

Huxel, C. J., Jr. *See* Yamanaga, George. 07609

07276 **Hyne, Norman John, Jr.** Sedimentology and Pleistocene history of Lake Tahoe, California-Nevada [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2765B, 1970.

07357 **Inderbitzen, Anton Louis.** Relationships between sedimentation rate and shear strength in recent marine sediments off southern California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2064B-2065B, 1970.

Ingvalson, R. D. *See* Rhoades, J. D. 07628

00221 **Inman, D. L.; Nordstrom, C. E.** On the tectonic and morphologic classification of coasts: Jour. Geology, v. 79, no. 1, p. 1-21, illus., tables, 1971.

In terms of large-scale effects of plate tectonics, there appear to be three major classes of coasts, depending on their position relative to the moving plates of the tectosphere: (1) collision coasts, those on the collision edge of continents and island arcs; (2) trailing-edge coasts, on the noncollision, trailing edge; and (3) marginal sea coasts protected by island arcs. A close correlation between certain morphologic and tectonic features of coasts was used to guide formulation of a morphologic classification that has tectonic implications. It is defined in terms of continental shelf width and adjacent landform relief: (1) mountainous coasts; (2) narrow-shelf coasts, hilly or plains; and (3) wide-shelf coasts, hilly or plains. — *from* Authors' abstract

Innes, D. G. *See* Bennett, G. 00324

Jackman, H. W. *See* Ehrlinger, H. P., 3d. 07246

07233 **Jackson, Togwell A.; Keller, W. D.** A comparative study of the role of lichens and "inorganic" processes in the chemical weathering of recent Hawaiian lava flows: Am. Jour. Sci., v. 269, no. 5, p. 446-466, illus., tables, 1970.

The lichen *Stereocaulon vulcani*, growing on recent lava flows on Hawaii Island, greatly accelerates chemical weathering of its substrate. The weathering crust of lichen-covered rock is thicker by some orders of magnitude than the weathering crust of bare rock; the lichen-covered weathering crust is enriched in Fe and impoverished in Si, Ti, and Ca with respect to lichen-free crust; the lichen-covered crust is an assemblage of residual oxides apparently devoid of clay minerals, but halloysite and mica-like material were detected in samples of lichen-free crust; and iron oxide in lichen-covered crust is mineralogically different from that in lichen-free crust. Biologic acceleration of chemical weathering can be explained by action of respiratory CO_2 and H^+ ions of organic acids; data also suggest action of organic complexing agents. — *from* Authors' abstract

Jacobs, Hyde S. *See* Foth, Henry. 00327

07431 **Jacobs, L. W.; Syers, J. K.; Keeney, D. R.** Arsenic sorption by soils: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 750-754, illus., tables, 1970.

Retention of As against extraction by NH_4OAc and Bray P-1 reagents from Wisconsin soils equilibrated with Na_2HAsO_4 increased as the sesquioxide content increased. Similarly, the amount of As sorbed from solution increased as the free Fe_2O_3 content of the soils increased. Removal of amorphous Fe and Al components by oxalate treatment eliminated or appreciably reduced As sorption capacity of the soil. Amorphous Fe and Al components preferentially sorbed added As, as shown by its quantitative removal from equilibrated soils by a single oxalate extraction and the essentially complete recovery of added As by NH_4F and NaOH reagents during chemical fractionation. Because As released during extraction with NH_4F is sorbed by soil components during the same extraction, NH_4F-As is underestimated unless a correction for resorption is made. — *from* Authors' abstract

07437 **Jaeger, J. C.** Behavior of closely jointed rock, Chap. 4 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 57-68, illus., table, 1970.

One of the problems in engineering and mining developments is that rock broken up into blocks by a network of intersecting joints is often encountered, and it is extremely difficult to determine the properties of such materials. A number of tests on single joints are described and their results are compared with triaxial tests on cores containing a considerable number of joints. Comparison is made between measurements on similar joints measured on 2- and 6-in diameter cores, and a brief comparison of these results is made with those from plate-bearing tests. — VSN

James, Odette B. *See* Chao, E. C. T. 07547

Jarosewich, Eugene. *See* White, John S., Jr. 07635

00283 **Jeletzky, J. A.** Marine Cretaceous biotic provinces and paleogeography of Western and Arctic Canada — Illustrated by a detailed study of ammonites: Canada Geol. Survey Paper 70-22, 92 p., illus., tables, 1971.

North Pacific and North American Boreal biotic provinces existed in Canada until latest Cretaceous; ammonite faunas are compared in detail between the provinces for each Cretaceous stage, and paleogeography is interpreted as shown on 16 maps. North Pacific faunas, which include a great variety of ammonites, pelecypods, and gastropods, were closely related to those of Indo-Pacific, Tethyan, and Andean provinces. This province was restricted to western Cordilleran and Peace River regions in the Berriasian-Barremian, and to western Cordilleran thereafter. North American Boreal faunas, dominated by a few very abundant molluscan species, were closely similar to those of Boreal seas of northern Eurasia. This province was restricted to Arctic islands, northern Yukon and adjacent Mackenzie in the Berriasian-Barremian; in Albian time, Boreal seas expanded southeastward and persisted until early Maestrichtian. Seaways connecting provinces were permanently closed by Aptian orogeny. — VMJ

00212 **Jenkins, W. A. M.** Palynology and Silurian-Lower Devonian ("Hunton") stratigraphy in the subsurface of Oklahoma and the Texas panhandle: Geol. Soc. America Bull., v. 82, no. 2, p. 489-492, 1971.

Palynology is ideally suited to the solution of stratigraphic problems encountered during petroleum exploration. It has revealed that over much of the Anadarko Basin "Hunton" beds rest upon Ordovician rocks no older than the world-wide *Dicellograptus complanatus* graptolite zone of Ashgill (Richmond) age, and suggests that in some parts of the basin uppermost Ordovician and basal "Hunton" strata form an unbroken depositional sequence. Palynology indicates that "Hunton" beds of Devonian age are missing on the northern limb of the basin. It proves the existence of a thick sequence of Lower Devonian carbonate rocks on the southern limb of the basin, thus providing the first record of *dated* Lower Devonian rocks on the southern limb of the Anadarko Basin beyond the immediate vicinity of the outcrops in south-central Oklahoma. — *from* Author's abstract

07307 **Jessop, A. M.** The effect of environment on divided bar measurements, *in* Geothermal problems — Symposium, Madrid, Spain, 1969, Proc.: Tectonophysics, v. 10, nos. 1-3 (spec. issue), p. 39-49, illus., tables, 1970.

Exchange of heat between the sides of a divided bar and the surrounding air may cause inaccurate measurement of thermal conductivity. Errors have been estimated for different types of divided bars, and for different relations of air temperature to bar-end temperatures. Errors can be kept to a minimum by good design of the bar and by good air temperature control. — Author's summary

07438 **John, Klaus W.** Civil engineering approach to evaluate strength and deformability of regularly jointed rock, Chap. 5 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 69-80, illus., 1970.

The geologic factor of greatest significance in rock mechanics and engineering is the geologic structure represented by joints, faults, and other planes of weakness. This structure differentiates between the *rock element* and the *rock system* composed of these elements. In this study, conventional methods of mechanics and engineering are utilized to provide realistic and pragmatic methods of rock mechanics analysis; concepts are given to quantitatively evaluate the effect of simplified geologic structures. Properties of a rock system are expressed in terms of parameters of both rock elements and geologic structure. Results of comparison of model tests with computed values showed good agreement with respect to strength and deformations. The system/element coefficients for strength and deformability ranges from 10-50 percent, whenever sliding apart along joint planes occurred. — VSN

07541 **Johns, Willis M.** Geology and mineral deposits of Lincoln and Flathead Counties, Montana: Montana Bur. Mines and Geology Bull. 79, 182 p., illus., tables, geol. maps, 1970.

This summary on mapping and mines in the Kootenai-Flathead project supersedes six earlier bulletins; geochemical studies indicate promising areas for further exploration. Beltian rocks, Paleozoic and later formations, igneous rocks, faults and folds, like those in the Coeur d'Alene district of Idaho, favor ore deposition. Similarities are recognized in host rocks, structures, mineralization, and age of ore deposits. Total metals production from the two counties is valued at 11.5 million dollars, but the region shows greater potential. Mesothermal and epithermal deposits in eight mining districts have yielded silver, lead, gold, zinc, copper, and tungsten; placer gold has come from Libby and Troy districts and less productive bars in Lincoln County. Vermiculite has been the major nonmetallic product; other possibilities are barite, bog-manganese, clay and talc. A new western copper discovery is being developed. — GDC

07174 **Johnson, Donald Lee.** Beachrock (water-table rock) in southern California [abs.]: Assoc. Pacific Coast Geographers Yearbook, v. 32, p. 179, 1970.

00306 **Johnson, J. G.** Some new and problematical brachiopods from the Devonian of Nevada: Jour. Paleontology, v. 45, no. 1, p. 95-99, illus., 1971.

Anoplia klapperi, n. sp., is described and compared with *A. elongata* of the Lower Devonian (Emsian) of central Nevada. The new species is not known from typical zonal assemblages and may represent a previously unsampled community. Pedicle valves of an unusual Lower Devonian (Siegenian) brachiopod of probable rhynchonellid affinities are described and compared with possible related forms. Their relations remain enigmatic. A single pedicle valve of the spiriferid *Howittia* is described from the Siegenian and represents the first occurrence of the genus in North America. A brachial valve of *Costispirifer* sp. is illustrated showing ribbing and cardinalia to good advantage. — *from* Author's abstract

07556 **Johnson, Kenneth S.** William E. Ham, 1916-1970: Oklahoma Geology Notes, v. 30, no. 5, p. 95-97, portrait, 1970.

07664 **Johnson, Leon J.** Clay minerals in Pennsylvania soils — Relation to lithology of the parent rocks and other factors, [Pt.] 1 [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 5, p. 247-260, illus., tables, 1970.

The 348 soil profiles studied represent 117 different soil series from 28 Pennsylvania counties; Precambrian to Pliocene parent rocks include igneous, metamorphic and various sedimentary types. Subsoil mica was the most prevalent clay mineral in 82 percent of the profiles; important in 95 percent of shale soils, and in 68 percent of limestone soils. Kaolinite, prominent in soils from sandstone and metamorphic rocks, reflects *in situ* weathering rather than inheritance. Montmorillonite, detected in half of the soils, is seldom prominent, more often found in poorly drained soils. A mica-kaolinite suite is characteristic of soils from Pennsylvanian age rocks, mica-chlorite of soils from Devonian, Mississippian, and Ordovician rocks, the chlorite often weathered to chlorite-vermiculite; rare are gibbsite, talc, and pyrophyllite. Clay mineral types diverge between different profiles in the same soil series; high calcareous rock soils may have unusual clay suites. — GDC

Johnson, Robert W., Jr. *See* Dennison, John M. 00303

Johnson, W. S. *See* Kruse, G. H. 07442

Joiner, Thomas J. *See* McWilliams, R. G. 07167

Jolly, Janice L. *See* Heyl, Allen V. 07470

00204 **Jolly, Wayne T.** Potassium-rich igneous rocks from Puerto Rico: Geol. Soc. America Bull., v. 82, no. 2, p. 399-408, illus., tables, 1971.

Upper Cretaceous volcanic rocks in south-central Puerto Rico consist of an early series of calc-alkaline andesites and a later series of shoshonites. These rocks are chemically and mineralogically related in many respects, but potassium-rich varieties display extreme enrichment in K_2O (more than 6 percent), Rb (up to 150 ppm), and Cu (up to 300 ppm). They all contain relatively high U (from 0.6 to 1.9 ppm) and Th (from 1 to 5 ppm) compared to typical andesites. The potassic magmas may have been generated in dehydrated oceanic crustal materials along the Benioff Zone at relatively high pressures. — *from* Author's abstract

Jones, E. J. W. *See* Sclater, J. G. 07308

Jordan, W. M. *See* Stanley, K. O. 00224

Josey, William L. *See* Kesler, Stephen E. 00301

07358 **Julian, Bruce Rene.** Regional variations in upper mantle structure beneath North America [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2065B, 1970.

07213 **Kantrowitz, I. H.** Ground-water resources in the Eastern Oswego River basin, New York — Oswego River Basin Plan. Rept. ORB-2: Albany, N.Y., New York State Water Resources Comm., 129 p., illus., tables, 1970.

In Eastern Oswego River basin, comprising approximately 2,500 sq mi in central New York, ground water for domestic supplies can be obtained but sources of large industrial or municipal supplies are not widespread. Principal aquifers are unconsolidated deposits of sorted and stratified sand and gravel. The most prolific are hydraulically connected to streams or rivers and are recharged by surface water. Potential yield ranges from 1 to 60 mgd with total yield about 280 mgd. Some surficial aquifers, recharged only by precipitation and runoff, have yields ranging from less than 0.4 up to 20 mgd. Others which underlie relatively impermeable materials are recharged only by slow movement of ground water and yield from 1 to 4 mgd. Two limestone and shale bedrock units crop out across the center of the basin and are capable of yielding large quantities of water particularly where crossed by streams. Ground water is generally of poor quality. — EH

Kaplan, R. I. *See* Presley, B. J. 07152

Karbs, Harlan H. *See* Abdel-Hady, M. 07248

Kaspar, I. *See* Kuraz, V. 07222

00215 **Katz, A.** Zoned dolomite crystals: Jour. Geology, v. 79, no. 1, p. 38-51, illus., 1971.

Four types of diagenetic zoning are shown in the dolomite crystals of the Middle Jurassic Mahmal Formation, southern Israel: these are zones of (1) *calcian dolomite*, formed through dilution of interstitial brine by sea water; (2) *polycrystalline calcite*, through more extreme dilution; (3) *ferroan dolomite* by shallow stagnant reducing environment; and (4) *polycrystalline hematite* by oxygenation during stormy periods. — REW

Keady, D. M. *See* Davis, Darrell E. 07335

Keen, C. E. *See* Barrett, D. L. 00269

00264 **Keen, Myra A.; Silberling, Norman J.; Page, Benjamin M.** Siemon William Muller (1900-1970): Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 133-134, portrait, 1971.

Keeney, D. R. *See* Jacobs, L. W. 07431

Keetch, Mary E. *See* Howard, Alan D. 07465

Keith, Stanton B. *See* Peirce, H. Wesley. 07209

Keller, W. D. *See* Jackson, Togwell A. 07233

07418 **Keller, W. D.** Geologic materials as sources of biologic nutrient elements, *in* Trace substances in environmental health III — Conf. on Trace Substances in Environmental Health, 3d Ann., Columbia, Mo., 1969, Proc.: Columbia, Mo., Univ. Missouri, p. 3-7, 1970.

All chemical elements which serve as biologic nutrients are, or were, derived ultimately from rocks. To understand the incongruency between abundance and availability of chemical elements in geologic materials, characteristics of rocks that make up the crust, and minerals that make up the rocks, must be studied. Primary-type rocks are composed dominantly of low-solubility silicates, accompanied by oxides and sulfides. These are being modified by weathering, the elements separated and regrouped as secondary rocks. The elements are more available to plants and animals in these secondary rocks. Elements occur in minerals in several modes, which affect their availabilities; Mg as a dominant cationic constituent is more available than in a silicate. Accessory minerals in a rock often contain more trace elements than essential minerals. The method of analysis is important to a plant nutritionist. — ESL

Kelley, James C. *See* Sonderegger, John L. 07660

07427 **Kelley, K. V., Jr.** Kelley's guide to fossil sharks: Ruskin, Fla., M and M Printing, 30 p., illus., 1970.

This popular collecting guide consists essentially of 72 captioned photographs of individual fossil shark teeth; data in the brief captions include: maximum dimension, generic and (usually) specific name, generalized locality and stratigraphic horizon (period or epoch only), and major distinguishing features of tooth. Some 58 species in 27 genera are covered, mostly selachians from the Miocene of the Atlantic and Gulf coasts, mainly Florida, and the California coast; a few elasmobranchs as old as Devonian (and a Cretaceous teleostean) are included. Congeneric species are usually grouped together, but there is no discernible systematic order otherwise, and many junior synonyms are not recognized as such. Frequently no horizon data are given, particularly for species that may be younger than Miocene. — VMJ

Kelling, Gilbert. *See* Fenner, Peter. 00258

Kennedy, G. C. *See* Williams, D. W. 07235

Kent, Bion H. *See* Berryhill, Henry L., Jr. 07216

07171 **Kent, Douglas C.** New FORTRAN-IV programs for electronic data processing of geophysical and water quality data in hydrogeological investigations: Oklahoma Acad. Sci. Proc. 1970, v. 50, p. 140-144, illus., 1970.

Large quantities of geophysical and water-quality field data were compiled by electronic data processing and used to define physical and hydraulic boundaries of a ground-water basin. Approximately 30 min of IBM 360-50 time (equivalent to 150 dollars) were required to compute and plot electronically the data from 451 resistivity stations, 172 seismic stations and 150 water sample locations as against 1,100 man-hours required if done manually; 20 additional man-hours were needed to transfer raw data onto computer punch forms. The EDP routines used in the geophysical and water-quality FORTRAN-IV programs are not unique, but the combination of routines forming the programs and the application of the programs are. — *from* Author's abstract

00301 **Kesler, Stephen E.; Bateson, J. Howard; Josey, William L.; Cramer, George H.; Simmons, Weldon A.** Mesoscopic structural homogeneity of Maya Series and Macal Series, Mountain Pine Ridge, British Honduras: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 97-103, 1971.

Mesoscopic structural observations do not support the interpretation (Dixon, 1955) that the Mountain Pine Ridge area of the Maya Mountains, British Honduras, is underlain by two Paleozoic units separated by a regional unconformity. We have found

no evidence for intense regional folding of the Maya Series prior to deposition of the Macal Series. Our structural observations are consonant with proposals of Bateson and Hall (in press) that the Mayan Macal Series be combined and renamed the Santa Rosa Group. — SEF

07330 **Kessler, L. G., 2d; Cooper, Fred G.** Channel sequences and braided stream development in the South Canadian River, Hutchinson, Roberts, and Hemphill Counties, Texas, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 263-273, illus., table, 1970.

The South Canadian River has a complex anastomosing channel system with at least eight aggradational channel sequences which can be distinguished on aerial photographs and in the field by vegetation changes and overlapping stratigraphic relationships. Flash floods eradicate parts of earlier channel sequences and set the stage for channel braiding under lower discharge rates. Despite similar average direction (nearly parallel to the orientation of the active channel in a given reach), there is wide variation of bar orientation in all reaches studied. Investigated areas show eolian dune alteration, the dunes paralleling the orientation of the river valley. Channel wall instability and variable discharge rate are the principal factors causing braiding in this river system; stream gradient is doubtful as a cause. — DBV

Kharin, G. S. *See* Yemel'yanov, Ye. M. 07211

07290 **Khattri, Kailash Nath.** Kinematic parameters of earthquakes [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2772B, 1970.

Kim, R. Y. *See* Hardy, H. R., Jr. 07451

Kimbler, Oscar K. *See* Kumar, Anil. 07415

07261 **Kimura, Hubert Satoshi.** Alkaline dissolution of kaolin, montmorillonite, Windy soil and saprolite clay minerals [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2413B, 1970.

00214 **King, Cuchlaine A. M.; McCullagh, M. J.** A simulation model of a complex recurved spit: Jour. Geology, v. 79, no. 1, p. 22-37, illus., tables, 1971.

A simulation model of a particular coastal spit is presented to illustrate the value of such models in studying the processes that lead to spit formation. Hurst Castle spit in Hampshire was chosen for the model. The computer program simulates the operation of waves from the west, storm waves, southeasterly waves, and waves from the northeast. A depth factor simulates the increasing depth of water offshore. This accounts for the increase in number of recurves toward the distal end. A refraction factor allows the curvature of the main ridge to be simulated. The proportion of random numbers allocated to these variables can be adjusted in the data input to elucidate the part they play in the formation of the spit. The close fit of the standard spit to the real spit suggests that the controlling variables are being correctly simulated. — *from* Authors' abstract

07507 **King, M. S.** Static and dynamic elastic moduli of rocks under pressure, Chap. 19 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 329-351, illus., table, 1970.

Results are presented of experimental measurements of ultrasonic wave velocity and of static stress-strain relations on a dry sandstone (Berea), previously found to exhibit transverse isotropy, under hydrostatic stresses to 8000 psi. The dynamic elastic moduli for a dry isotropic sandstone are higher than the corresponding static moduli determined concurrently, and the ratio of these moduli decreases as hydrostatic stress increases. Differences result from randomly oriented lenticular cracks in the rock which close progressively as hydrostatic stress is increased. The dynamic elastic moduli for a dry, transversely isotropic sandstone are higher than the corresponding static moduli, and ratios decrease as above. The difference between static and

dynamic moduli is greater perpendicular to the bedding plane than parallel to it, due to two series of lenticular cracks, one randomly oriented, and one in the bedding plane. — VSN

07571 **Kissel, David Edwin.** A study of some reactions of acidity in selected Kentucky soils [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1009B, 1970.

07665 **Kittrick, J. A.** Precipitation of kaolinite at 25°C and 1 atm [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 5, p. 261-267, illus., 1970.

After equilibrating montmorillonite from three sources with various solutions at room temperature for 3 to 4 years, kaolinite was found in samples supersaturated with respect to kaolinite, but not in undersaturated ones nor in the original montmorillonite. X-ray diffraction analysis of precipitated kaolinite showed no interlayer expansion of glycerated, oriented samples; random powder samples indicated a poor crystallinity; its thermal stability was indistinguishable from that of crystalline kaolinite; the electron microscope revealed no distinct sizes or shapes. Defined by equilibration behavior of several samples, the kaolinite solubility line at or above which precipitation apparently begins is equivalent to a standard free energy of formation of -904.2 kcal per mole of kaolinite, highly crystalline. The stability of kaolinite actually precipitated at room temperature in soils and sediments could range from poorly crystalline up to this equivalent. — GDC

07430 **Klobe, W. D.; Gast, R. G.** Conditions affecting cesium fixation and sodium entrapment in hydrobiotite and vermiculite: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 746-750, illus., tables, 1970.

Cesium fixation and sodium entrapment studies were conducted using vermiculite materials with different K saturations. Over 95 percent of the sorbed Cs was fixed above 1 percent Cs saturation of the exchange capacity, regardless of K levels or whether K was residual in hydrobiotite or added to the vermiculite prior to addition of Cs; trace levels of Cs were fixed to a much lesser extent, indicating it may be more available for plant uptake. X-ray and Na-entrapment results indicate that low Cs saturations result largely in interstratified Cs- and Na-rich layers with little edge collapse. At higher Cs saturations, increasing edge collapse and Na entrapment occur. Formation of interstratified layers vs. edge collapse tends to be associated respectively with smaller and larger particles. — GDC

07486 **Klosterman, Gregory E.** Mineral aggregates, exploration, mining and reclamation, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 233-241, illus., 1970.

One of the largest producers of sand, gravel and stone with over 30 plants in Indiana, Ohio, and Michigan, produces at the rate of 25 million tons annually which consumes 300-400 acres of land. Reserve replacement at this rate is a never-ending task; exploration is generally confined to distant rural areas, using various types of drilling equipment. Mining and reclamation are interdependent and executed simultaneously; preplanning of all operations is based on drill data; and methods of operation, including digging, transportation and beneficiation, along with reclamation procedures are all part of the preplnning program. Jurisdictional control of irreplaceable raw materials should be at the state level, where control would result in utilizing and conserving these natural resources in a most efficient way. — *from* Author's abstract

07212 **Klotz, John W.** Genes, Genesis and evolution (2d revised edition): Saint Louis, Mo., Concordia Publishing House, 544 p., illus., tables, 1970.

The author contends that evolution in the accepted sense of the term has not taken place. Change in the landscape, flora and fauna that has occurred is not the development of higher organisms from lower ones, but rather a finite amount of change within a fixed and closed system. — EH

07518 **Kneller, W. A.** (editor). Sixth forum on geology of industrial minerals, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, 155 p., illus., tables, 1970.

The two themes of this forum are: chemical and industrial rocks and minerals (9 papers, 7 cited separately) and building and construction stones and minerals (9 papers, 7 cited separately). — MCM

07310 **Knopoff, L.; Schlue, J. W.; Schwab, F. A.** Phase velocities of Rayleigh waves across the East Pacific Rise, *in* Geothermal problems — Symposium, Madrid, Spain, 1969, Proc.: Tectonophysics, v. 10, nos. 1-3 (spec. issue), p. 321-334, illus., tables, 1970.

The phase velocity of Rayleigh waves across part of the Pacific Ocean has been measured by a modification of the single-station technique. A phase velocity curve with an unusual reversed slope has been obtained for a line crossing the East Pacific Rise. The class of inverse structures consistent with these observations to within 0.05 km/sec over the period range includes structures with extremely low channel velocities. — Authors' abstract

Knox, E. G. *See* Carstea, D. D. 07618

07299 **Ko, Kyung Chul.** The failure criteria and deformational moduli of granular rock [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2734B, 1970.

Korcak, R. F. *See* Fanning, D. S. 07629

00284 **Kornfeld, Joseph A.** New Cretaceous oil boosts San Juan basin activity: World Oil, v. 172, no. 4, p. 59-60, illus., 1971.

Completion of excellent wells producing 250-500 bopd from depths as shallow as 2,800 feet has focused new attention on northwestern New Mexico. Reservoirs found to date, principally by independent operators, are relatively small, but several companies plan extensive drilling programs to further determine potential of the area. — Author's abstract

Kramer, David J. *See* Odom, I. Edgar. 07521

Kreye, Heinrich. *See* Hornbogen, Erhard. 07214

07203 **Krinitzsky, E. L.** The effects of geological features on soil strength: U.S. Army Corps Engineers Water ways Expt. Sta. Misc. Paper S-70-25, 103 p., illus., tables, 1970.

X-ray examinations of fine-grained soils from the Lower Mississippi Valley revealed numerous geologic features not visible to the unaided eye, including significant fracture patterns, details of planar bedding, cross-laminations and turbulence, secondary mineralizations, root penetrations and voids left by roots, disseminated organic matter, and other details. These features affect the strength properties of the soils in which they occur. Experiments with multiple specimens from single samples embodying different features demonstrated that many large variations in strength properties were not only directly dependent on these features but were predictable in a relative sense. Normally, these features are never identified during routine soils testing although the effects contribute to erratic test results. Pretest radiographic examination is a potential means of avoiding these problems. — *from* Author's abstract

00314 **Kristof, Stevan J.** Preliminary multispectral studies of soils: Jour. Soil and Water Conserv., v. 26, no. 1, p. 15-18, illus., 1971.

Increasing need for more accurate and faster methods of mapping soils requires that new methods to aid this important work be investigated. Preliminary multispectral studies with soils indicate the possibility of producing soil spectral maps using remote-sensing techniques. The relationship of spectral measurements of soils and soil properties are discussed. In the future, computer maps may aid the mapping and study of soil patterns on a large scale. Mapping and detailed study of soil associations

appear to be entirely possible with the techniques described. — *from* Author's abstract

07531 **Krueger, Allen R.** Alpha's sand and gravel deposit and processing plant at Martins Creek, Pennsylvania, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 91-103, illus., tables, 1970.

Glacial deposits of the Delaware River valley region contain numerous deposits of sand and gravel, both valley train deposits of stratified drift and Wisconsin outwash. At Martins Creek, Pa., a deposit which now forms a terrace some 50 feet above the present river level, contains abundant coarse gravel, with cobbles and numerous boulders; 60 percent of the material averages greater than 4 mesh size. A processing plant for sand and gravel meeting specifications of the Pennsylvania Department of Highways, and based on a complete geologic investigation of the deposit, is a good example of applied industrial geology. — *from* Author's abstract

07442 **Kruse, G. H.; Zerneke, K. L.; Scott, J. B.; Johnson, W. S.; Nelson, J. S.** Approach to classifying rock for tunnel liner design, Chap. 10 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 169-192, illus., tables, 1970.

The development of a qualitative visual rock classification system, the use of the classification system in conjunction with in-situ rock test data (rock bolt, extensometer) and seismic velocity data, and an interdisciplinary appraisal of effectiveness of the system in application to design of tunnel liners are discussed. The system was developed in designing a pumping lift for the California Aqueduct across the Tehachapi Mts. The basic concept is that the steel lining, concrete backfill, and rock mass act as an integral structure. Varying load-bearing response of the rock requires that the liner design include alternatives for adjustment to field conditions. Rocks are classified as of good, intermediate, and poor quality, and the initial classification is based on geologic logging data. The detailed chart for the system is illustrated. — VSN

07415 **Kumar, Anil; Kimbler, Oscar K.** Effect of dispersion, gravitational segregation, and formation stratification on the recovery of freshwater stored in saline aquifers: Water Resources Research, v. 6, no. 6, p. 1689-1700, illus., tables, 1970.

A calculation procedure, using analytical and empirical relations, to predict mixing and gravitational segregation in a horizontal radial flow system, yields results that agree well with experimental results with a three-dimensional laboratory flow model in which both mixing and gravitational segregation occurred simultaneously. The calculation procedure was applied to prediction of efficiency with which freshwater stored in saline aquifers might be recovered. Low aquifer water salinity, low formation permeability, and low formation thickness lead to the most favorable recoveries. The calculation procedure indicates that recovery efficiency improves with the number of injection-production cycles, suggesting that even for unfavorable conditions the process might become feasible on a long-term basis. Graphical presentations show the relative importance of several pertinent variables including formation stratification. — *from* Authors' abstract

00315 **Kunkle, Samuel H.; Comer, George H.** Estimating suspended sediment concentrations in streams by turbidity measurements: Jour. Soil and Water Conserv., v. 26, no. 1, p. 18-20, illus., 1971.

Turbidity and suspended sediment analyses were made on stream samples collected in the Sleepers River and watershed of northeastern Vermont. Results showed that turbidimeter readings could be used to estimate suspended sediment concentrations on the 16- to 6,366-mg per liter range observed by using the prediction equation $Y = AX^B$. The equation was similar for the three watersheds studied, where soils, topography, and other factors were essentially the same. Samples were collected during two years of storm and snowmelt runoff on catchments draining from 16.2 to 43.5 sq

km. Discharges ranged from 140 to 180,000 liters per sec. The sediment particles were mostly of stream-bank origin and were primarily silt or very fine sand. — Authors' abstract

07222 **Kuráz, V.; Kutílek, M.; Kaśpar, I.** Resonance-capacitance soil moisture meter: Soil Sci., v. 110, no. 4, p. 278-279, illus., 1970.

The resonance-capacitance method recently developed in the Technical University, Prague, is a procedure where relatively inexpensive equipment is used. The maximum error for moisture content of an undisturbed soil body is 1.5 percent. — JWH

Kutílek, M. *See* Kuraz, V. 07222

07148 **Kuykendall, W. E., Jr.; Hoffman, Buren W.; Wainerdi, R. E.** 14-MeV neutron activation analysis of selected Leg 5 core samples, Chap. 17 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 485-486, table, 1970.

Each core sample was crushed, mixed, and packaged in vials. Standards containing known amounts of oxygen, silicon, iron, magnesium, potassium, and aluminum were prepared, as well as U.S.G.S. standard rocks G-2, BCR-1, and GSP-1. A table lists the major-element composition of the selected samples. — ESL

Ladanyi, B. *See* Hoyaux, B. 07448

07508 **Ladanyi, B.; Archambault, G.** Simulation of shear behavior of a jointed rock mass, Chap. 7 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 105-125, illus., 1970.

A general framework for shear behavior of a rock mass is established that can be directly related to basic rock parameters and take into account the effect of previous deformations. Strength behavior of the proposed model is compared with results of direct shear tests simulating behavior of a jointed rock mass on a laboratory scale. The theoretical failure model proposed is based on energy considerations rather than a purely statical approach, and follows a line of thought similar to that used by Rowe et al. (1964) in analyzing direct shear in sand. From experimental evidence, it is concluded that the strength simulation model reflects relative contributions of relevant parameters to overall shearing strength of irregular rock surfaces, and can serve as a tool for interpreting results of large-scale direct shear tests performed in situ. Potentially it can predict strength of a rock mass from strength of its components. — VSN

07227 **LaFleur, K. S.** Color of heated South Carolina Ultisols: Soil Sci., v. 110, no. 6, p. 379-382, illus., tables, 1970.

Samples were heated to 600°C for 3 hours, re-equilibrated at 65 percent relative humidity at room temperature, and then the color was measured using the Muncell designations. The dominant pigment of the B_{2t} horizon of South Carolina Ultisole is ferric oxide. The Muncell hue and value of these soils is a function of the ferric oxide concentration, degree of hydration, and probably particle size. — JWH

07298 **Lammers, George Eber.** The late Cenozoic Benson and Curtis Ranch faunas from the San Pedro Valley, Cochise County, Arizona [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2862B, 1970.

07164 **Land, P. E.** Rancho Capay gas field: California Oil Fields — Summ. Operations 1970, v. 56, no. 1. p. 33-37, illus., tables, 1970.

Formations in the Rancho Capay gas field (northern part of the Sacramento Valley) range from Upper Cretaceous Dobbins Shale to Holocene alluvium. The structure is an elongated dome cut in the northern part by a minor fault. Producing zones are the Moda gas sand near the base of the Pliocene Tehama Formation, the Kione sand lens, and the thin Forbes zones. Total production to date is 1,346,787 Mcf gas. — MCM

07456 **Lane, K. S.** Engineering problems due to fluid pressure in rock, Chap. 26 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 501-540, illus., 1970.

Current concepts on effects of fluid pressure in rock, the fragmentary nature of evidence available to support these concepts, and the significance of fluid pressure in several types of engineering problems are discussed. Terzaghi's pore pressure concepts are divided into two phases: that friction strength is determined by effective or intergrain stress, and that pore pressure is induced by loading, with magnitude and sign being dependent on relative compressibilities of grain structure and pore fluid. It is concluded that research laboratories should pay attention to possibilities of load-induced pore pressure by measuring volume change and utilizing undrained triaxial tests; fragmentary evidence suggests that shock loading creates a significant dynamic pore pressure in a rock mass; fluid pressure in a rock mass is often a controlling element in stability problems; and changes from initial equilibrium in underground fluid pressures have been responsible for major foundation movements. — VSN

Langford, N. Gerald. *See* Gould, Joseph C. 07190

Lapham, Davis M. *See* Bolles, William H. 07559

LaRochelle, P. *See* Tamuly, A. L. 07443

07294 **Larson, Douglas William.** On reconciling lake classification with the evolution of four oligotrophic lakes in Oregon [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2805B, 1970.

07597 **Larson, Roger Lee.** Near-bottom studies of the East Pacific Rise crest and tectonics of the mouth of the Gulf of California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1431B-1432B, 1970.

00316 **Latterell, J. J.; Holt, R. F.; Timmons, D. R.** Phosphate availability in lake sediments: Jour. Soil and Water Conserv., v. 26, no. 1, p. 21-24, tables, 1971.

Lake bottom sediment from three lakes in west-central Minnesota was equilibrated with calcium chloride solutions containing from 0.05 to 42 ppm phosphorus. The sediments from each lake showed a high capacity to remove orthophosphate from the equilibrating solution. Although sediment can act as a reservoir of orthophosphate, results indicate that orthophosphate concentration in surface water may be low before the sediment will release orthophosphate to the water. — Authors' abstract

07277 **Laughon, Robert Bush.** The crystal structure of a new hydrous calcium copper silicate mineral [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2766B, 1970.

Lavery, Norman G. *See* Barnes, Hubert L. 07404

07432 **Lavkulich, L. M.; Wiens, J. H.** Comparison of organic matter destruction by hydrogen peroxide and sodium hypochlorite and its effect on selected mineral constituents: Soil Sci. Soc. America Proc. v. 34, no. 5, p. 755-758, illus., tables, 1970.

The destruction of organic matter from widely different soils was evaluated by using hydrogen peroxide and sodium hypochlorite oxidation procedures. The amounts of extractable Si, Mn, Al, and Fe were determined on the residues following treatment with the oxidizing agents by using acid ammonium oxalate and 0.5*N* NaOH extraction procedures. In addition, the amount of Si, Mn, Fe, and Al in the extracting solutions was determined. It was found that NaOCl extracted more organic matter with less destruction of the oxides than procedures employing H_2O_2. This was substantiated statistically using the *t*-test as applied to paired values. Three treatments with NaOCl were concluded to be satisfactory for destruction of organic matter with minimum removal of Si, Mn, Fe, and Al. — Authors' abstract

00321 **Leahy, E. J.; Rupert, R. J.; Giblin, P. E.; Giguere, J. F.** (compilers). Wawa sheet, Districts of Algoma and Sudbury: Ontario Dept. Mines and Northern Affairs Prelim. Map P.640 (Geol. Compilation Ser.), scale 1 in. to 2 mi., 1971.

Leighton, Fred. *See* Blake, Wilson. 07453

Leland, Harry V. *See* Shimp, Neil F. 00279

Lemmon, Robert E. *See* Fullagar, Paul D. 00205

07615 **Leonard, R. A.; Weed, S. B.** Mica weathering rates as related to mica type and composition [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 4, p. 187-195, illus., tables, 1970.

Potassium release rates from micas varying widely in type and composition were measured. A sodium tetraphenylboron solution was used as the extracting agent. Muscovites were found to be two orders of magnitude more stable than a naturally occurring phlogopite and biotite. Synthetic fluorphlogopite was as stable as some muscovites. Lepidolite was the most stable mica. Primary factors affecting mica stability are thought to be: hydroxyl bond orientation, isomorphous replacement of OH^- by F^-, the stronger Lewis base, and structural factors that lead to compression or stretching of the K-O bond. — Authors' abstract

07616 **Leonard, R. A.; Weed, S. B.** Effects of potassium removal on the *b*-dimension of phlogopite [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 4, p. 197-202, illus., tables, 1970.

Potassium was removed from 5 to 20-μ size fractions of two phlogopites by treatment with sodium tetraphenylboron and replaced with various exchange ions. The *b*-dimension of the mica increased with K^+ removal, which suggests that the K^+ ion in phlogopite acts to constrain *b*. This being the case, the K-O bond in phlogopite must be lengthened and weakened relative to the K-O bond in dioctahedral micas. — Authors' abstract

07573 **Leonhardy, Frank Clinton.** Artifact assemblages and archaeological units at Granite Point Locality 1 (45WT41), southeastern Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1030B, 1970.

07278 **Lessard, Robert Henry.** Micropaleontology and paleoecology of the Tununk Member of the Mancos Shale [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2766B-2767B, 1970.

Lewis, A. J. *See* MacDonald, H. C. 00202

07593 **Lewis, Brian Thomas Robert.** An isostatic model for the U.S.A. derived from gravity and topographic data [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1355B, 1970.

Lewis, D. E., Jr. *See* Dixon, J. B. 07433

07489 **Limerinos, J. T.** Determination of the Manning coefficient from measured bed roughness in natural channels: U.S. Geol. Survey Water-Supply Paper 1898-B, p. B1-B47, illus., tables, 1970.

To test the Manning coefficient of stream-bed roughness as related to characteristic size of particles and to distribution of particle size, 50 measurements of discharge were made in California covering a suitable range in stream depth; they were confined to channels with coarse material at 11 sites, relatively free of flow-retarding effects of irregular channel form and vegetation, and selected to give a wide range in average size material. Bed particles in the 16-, 50-, and 84-percentile sizes were used in analyses; minimum diameters, invariably vertical, represent roughness height; intermediate ones, most easily measured, show no difference in reliability. Relations obtained by using a characteristic diameter in the 84-percentile size were slightly

better than results obtained by weighting three characteristic sizes. A small standard of error had little significance in relating the roughness parameter to 27 sets of velocity ratios at 0.2 and 0.8 depths. — GDC

07574 **Lindstrom, Richard Mark.** Radionuclides in meteorites and in the lunar surface [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1143B-1144B, 1970.

07586 **Liou, Juhn-Guang.** Stability relations of zeolites and related minerals in the system CaO-Al_2O_3-SiO_2-H_2O [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1351B, 1970.

07503 **Lisitsyna, N. A.** K geokhimii kor vyvetrivaniya osnovnykh porod tropicheskoy zony Tikhogo Okeana [Geochemistry of weathering profiles developed on basic rocks in tropical zone of the Pacific Ocean]: Kora Vyvetrivaniya 1970, no. 11, p. 214-233, illus., tables, 1970.

Olivine basalts from Hawaii, Tahiti, and Western Samoa have a porphyritic structure, containing plagioclase, olivine, pyroxene, and magnetite. The Tertiary-early Pleistocene basalts show SiO_2 50.25, TiO_2 2.36, Al_2O_3 13.95, Fe_2O_3 7.20, FeO 5.38, MnO 0.18, MgO 5.81, CaO 8.47, Na_2O 2.75, K_2O 0.47, H_2O - 1.55, H_2O + 0.64, and P_2O_5 0.45 percent. X-ray diffraction analysis of clay minerals from the weathered zone shows metahalloysite, kaolinite, and gibbsite. Presence of Co, Ni, Cu, Zn, Pb, Cr, and V in the weathered basaltic rocks are detected by spectrochemical methods. Na, Ca, Mg, and K contents decrease with the degree of weathering. Vertical profiles of weathered zones are drawn showing the existence and paucity of different trace elements.

Litvin, V. M. *See* Yemel'yanov, Ye. M. 07211

07279 **Lodewick, Richard Ballard.** The petrology and stratigraphy of the Earp Formation, Pima and Cochise Counties, Arizona [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2767B, 1970.

00207 **Lovejoy, Earl M. P.** Tectonic implications of high level surfaces bordering Franklin Mountains, Texas: Geol. Soc. America Bull., v. 82, no. 2, p. 433-445, illus., table, 1971.

High level, early to mid-Pleistocene piedmont and pediment deposits and surface along the southern Franklin Mountains extend out towards bolson fill deposits and surfaces. On the east side of the range 400 feet of post-bolson displacement produced a westward tilt of 2.3° between .25 and 2.0 m.y. ago, which is about 6.6 percent of the total block rotation. Assuming a constant rate of rotation, the inception of uplift is between 4 and 30 m.y. ago. — *from* Author's abstract

07390 **Lowell, J. David.** Copper resources in 1970: Mining Eng., v. 22, no. 4, p. 67-73, illus., 1970.

A broad look at the copper picture from the beginnings of the industry in 3300 B.C. is presented here along with a careful examination of the prospects for copper exploration, production, and consumption up to the year A.D. 2000. Porphyry deposits will account for most of the copper mines of the future. Grades are expected to continue downward as prices move upward. — *from* Mining Engineering abstract

00208 **Lumsden, David N.** Markov chain analyses of carbonate rocks — Application, limitation, and implications as exemplified by the Pennsylvanian System in southern Nevada: Geol. Soc. America Bull., v. 82, no. 2, p. 447-461, illus., tables, 1971.

Markov chain analysis may be used to evaluate the presence of "memory" in a sequence of physical events, in this case cyclic vertical facies variations in sedimentation. It was found by measuring three sections of Pennsylvanian carbonate rocks in Nevada, that the miogeosynclinal Bird Spring Group with a chi-square value of 167.41 had a memory as did the Frenchman mountain section of the shelf facies of

the Callville Formation (chi-square 26.40), whereas the shelf facies of Azure Ridge (chi-square 15.02) had no memory. — *from* Author's abstract

07388 **Lumsden, Jesse Beadles, 3d.** Quadrupole splitting of Al-27 nuclear magnetic resonance in topaz [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2222B, 1970.

07564 **Lund, Richard.** Fossil vertebrates from the Pittsburgh area, *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 80-83, illus., 1970.

Fossil remains of vertebrate animals are relatively common in Allegheny County. Fish, amphibian and reptile remains consist most commonly of teeth, then of scales and bones. Sediments typical of quiet-water deposition are potential sources of the various fossil vertebrates described. — EH

Luther, Edward T. *See* Avery, Gleason G. 07543

07546 **Luther, Edward T.; Avery, Gleason G.** Geologic map (and five coal maps) of the Norma quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 128-SW, 6 sheets, scale 1:24,000, separate text, 1970.

Coal maps cover the Windrock, Walnut Mountain, Jellico, Poplar Creek, Pewee, Upper Pioneer, Joyner, Blue Gem, Petros, Coal Creek, Ant, and Big Mary Seams. The accompanying text, "Mineral resources summary of the Norma quadrangle, Tennessee," by G. G. Avery and E. T. Luther is cited separately. — MCM

00265 **Lynch, W. D.; Harris, R. Merrill.** Henry N. Toler (1901-1970): Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 134-135, portrait, 1971.

00244 **MacAdam, R. B.** Preservation of organic-walled microfossil types studied by scanning electron microscopy: Jour. Paleontology, v. 45, no. 1, p. 140, 1971.

A technique simplified from Urban (1968) is described by which a single organic-walled microfossil can be studied by scanning electron microscopy and then be permanently mounted for study by light microscopy. — *from* Author's abstract

00202 **MacDonald, H. C.; Lewis, A. J.; Wing, R. S.** Mapping and landform analysis of coastal regions with radar: Geol. Soc. America Bull., v. 82, no. 2, p. 345-357, illus., 1971.

Although aerial photographs still constitute an important source of information for the coastal geomorphologist, data acquisition is severely limited in cloud-shrouded coastal environments. Sequential radar mapping of remote coastlines, however, provides a practical and rapid method of updating maps and monitoring coastal processes. Contrasts in signal return from the land-water boundary produce a striking interface on radar imagery which is advantageous for the delineation and mapping of coastal features. Radar imagery also provides the geomorphologist with most of the information interpretable from aerial photographs. [Imagery along the Pacific and Caribbean coasts of eastern Panama and northwestern Colombia is discussed in illustration of the technique.] — EHP

Mackenzie, F. T. *See* Bricker, O. P. 07512

07460 **Mackenzie, R. C.** (editor). Differential thermal analysis — V. 1, Fundamental aspects: London and New York, Adademic Press, 775 p., illus., tables, 1970.

Differential thermal analysis is the most widely used, and probably the most useful, thermoanalytical method. There is at present no comprehensive, authoritative, interdisciplinal, and critical account of the method, its fundamentals, potentialities, and applications; the present work is designed to fill this gap. The volume is divided into three sections: general, inorganic material, and organic materials, comprised of a total of 25 chapters by 24 contributors; one chapter is cited separately. The authors

are in many disciplines and from many countries, and all are specialists in their own fields. C ESL

MacKenzie, W. S. *See* Taylor, G. C. 07207

07280 **MacKenzie, Wallace Bruce.** Hydrothermal alteration associated with the Urad and Henderson molybdenite deposits, Clear Creek County, Colorado [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2767B, 1970.

07490 **MacKevett, E. M., Jr.** Geology of the McCarthy B-4 quadrangle, Alaska: U.S. Geol. Survey Bull. 1333, 31 p., illus., table, 1970.

A sequence of layered consolidated rocks more than 30,000 feet thick, small plutons, and widespread surficial deposits, range from Permian(?) and Permian to Quaternary. Permian(?) submarine lavas and derivative volcaniclastic rocks are overlain by Permian sediments. Middle Triassic marine sediments lie unconformably above them. Nikolai Greenstone, late Middle to early Late Triassic age, is disconformbaly overlain by Late Triassic Chitistone and Nizina Limestones which grade into McCarthy Formation of Late Triassic or Early Jurassic age. A major regional orogeny occurred in Late Jurassic or Early Cretaceous. Marine Cretaceous sediments unconformably overlie the older rocks. Uplift, deformation and erosion occurred before Tertiary Wrangell Lava volcanism. Continental sediments of Frederika Formation are intercalated in Wrangell Lava. Tertiary plutons, dikes and sills are present. Quaternary surficial deposits are largely related to glacial processes. Silver is minor in numerous copper deposits. Local gold placers and a few lodes contain gold, antimony, arsenic or molybdenum. — *from* Author's abstract

07469 **Magorian, Thomas R.** Vegetation and watershed shape: Water Resources Research, v. 6, no. 6, p. 1759-1764, illus., 1970.

The length L of vegetated first order watersheds developed by fluvial erosion is related to the width W by $L = W^2/RU$, where R is 3 for converging random walks of step size U, whose observed mean is 3 meters for normal dendritic drainage and 40 meters for basins over 300 meters long that drain directly into third or higher order streams. Bare soil watersheds show the relation $L = 0.4W$. — Author's abstract

Majeske, E. C. *See* Anderson, Raymond J. 07520

07281 **Mallio, William Joseph.** Geochemistry of pyrrhotite from metamorphosed pelitic rocks in western Maine [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2768B, 1970.

00304 **Mamet, B. L.; Skipp, Betty; Sando, W. J.; Mapel, W. J.** Biostratigraphy of Upper Mississippian and associated Carboniferous rocks in south-central Idaho: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 20-33, illus., 1971.

Carboniferous rocks above the Milligen Formation in the central Lost River Range of south-central Idaho range in age from Late Mississippian through Pennsylvanian, as determined by small calcareous foraminifers, corals, and brachiopods. The lower part of the post-Milligen sequence, largely limestone, is Mississippian and is divided into four formations. These rocks are underlain by an unnamed Pennsylvanian sandstone which, in turn, is overlain by a thick sequence of unnamed Pennsylvanian limestone. The composite section in the Lost River Range has a minimum exposed thickness of 7000 feet. Two partial sections in the Hawley Mts. are designated reference sections for the four formations of Mississippian age in the Lost River Range — Middle Canyon Formation at the base, and Scott Peak, South Creek, and the Surrett Canyon Formations. — *from* Authors' abstract

Manbeian, T. *See* Waldron, L. J. 07228

Manchester, K. S. *See* Barrett, D. L. 00269

00239 **Manger, Walter L.** The Mississippian ammonoids *Karagandoceras* and *Kazakhstania* from Ohio: Jour. Paleontology, v. 45, no. 1, p. 33-39, illus., 1971.

These genera, originally described from Kazakhstan, U.S.S.R., are sparsely represented in the Mississippian, Cuyahoga and Logan Formations in Ohio and suggest a Kinderhookian age for these rocks. *Karagandoceras* is reported from North America for the first time, as *K. bradfordi*, n.sp., from the Byer Member of the Logan. A new genus, *Voehringerites* is proposed for specimens from Hönnetal, Sauerland, West Germany formerly referred to *Karagandoceras*. — JWH

07151 **Manheim, F. T.; Chan, K. M.; Sayles, F. L.** Interstitial water studies on small core samples, Deep Sea Drilling Project, Leg 5, Chap. 20 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 501-511, tables, 1970.

Leg 5 samples fall into two categories with respect to interstitial water: rapidly deposited terrigenous material, and slowly deposited pelagic clays and biogenic muds and oozes. In the former, interstitial waters show modest variations in chloride and sodium, but drastic changes in nonconservative ions; while pelagic deposits show only minor changes in both conservative and nonconservative constituents. Mg values from Hole 35 in the Escanaba trough, are the lowest recorded from oceanic pore fluids; also, the water content is lower than from other sites. Sediments from this hole have all been considered Pleistocene. Major and minor constituents in the pore water are tabulated. — ESL

07129 **Mantek, William.** Review of current activity in the Niagaran reef belt in northern Michigan, Tech. Paper 9 *in* Ontario Petroleum Inst., 9th Ann. Conf., Ottawa, 1970: Chatham, Ontario, Ontario Petroleum Inst., 12 p., paged separately, illus., 1970.

After a slow and unimpressive start, the northern Michigan Niagaran reef activity is proving successful and gathering momentum. The success ratio is improving mainly because of successful seismic interpretation methods; 11 discoveries to date include six oil and five gas discoveries. Problems have been encountered with up-hole lost circulation zones, low porosities and permeabilities, barren reefs, partial salt plugging, sour hydrocarbons, high pressures, and etc.; however, excellent discovery wells such as the 1-4 Charlton, the N-1 State-Chester, and the 1-21 Donovan have justified the effort. Seismic methods seem to hold the magic key and should produce many more discoveries. — *from* Author's conclusions

07302 **Mantuani, Mark Anthony.** Sediment-water relations in lakes of the lower Grand Coulee, Washington [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2483B, 1970.

Mapel, W. J. *See* Mamet, B. L. 00304

Mark, Harry B., Jr. *See* Mattson, James S. 07130

00272 **Marshall, Monte; Cox, Allan.** Effect of oxidation on the natural remanent magnetization of titanomagnetite in suboceanic basalt: Nature, v. 230, no. 5288, p. 28-31, illus., 1971.

An experimental investigation was undertaken to determine whether any memory of the original natural remanent magnetization of rocks persists through the introduction of cation vacancies and changes in the crystal lattice during oxidation. The samples used were submarine basalts from the Pacific and Indian Oceans. It is reported that the natural remanent magnetization of titanomagnetite is not destroyed by oxidation if the oxidation occurs below the original Curie temperature of the titanomagnetite. — DBV

07408 **Martin, James A.; Rueff, Ardel W.** Paleocollapse — Determinant of a quarry failure [abs.]: Mining Eng., v. 22, no. 9, p. 53, 1970.

Martin, Larry D. *See* Schultz, C. Bertrand. 07638

Martin, R. F. *See* Piwinskii, A. J. 07661

Masland, Frank A., Jr. *See* Socolow, Arthur A. 07487

07320 **Mateker, Emil J., Jr.** Yesterday, today, and tomorrow in seismic exploration, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 129-132, 1970.

A significant improvement in the future resolving power of seismic exploration is envisioned, through an expansion of the geologic information generated from reflection data with the help of computers. In the early stages of the "digital revolution" the signal00/noise ratio was improved largely because computers made common-depth-point shooting techniques, repetitive use of low-energy, non-dynamite sources, and various signal-processing techniques practical. The recorded data also contain information about the types of rocks through which the energy has propagated, that can be extracted, for example, in the form of velocity and attenuation variations which will permit lithologic identification. To measure the resolving power of the seismic method, this simple equation must be evaluated: geometric configuration + lithologic distribution = geologic section. — DBV

Mateiski, R. P. *See* Petersen, G. W. 07428

07603 **Matthews, R. David.** The distribution of Silurian potash in the Michigan Basin, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 20-33, illus., table, 1970.

Geologic and geochemical evidence from core samples of sylvinite at Midland, Mich., supports the conclusion that potash underlies some 13,000 sq mi of the Michigan Basin. The potash is restricted to the basal salt member (A-1 Salt) of the Silurian Salina Group; lateral and vertical evaporite lithofacies successions are present around the deposit. Because of radial influx, brine concentrations increased toward the center of the basin during the A-1 Salt megacycle. The existence of trapped brines during intercyclic carbonate deposition and timing and influence of reflux currents during each evaporite megacycle are major factors explaining the potash-bearing Salina sequence. The A-1 potash was deposited at the midpoint of the first evaporite megacycle before reflux currents developed in the newly restricted basin. The presences of this newly-discovered evaporite lithofacies in the Michigan Basin is compatible with a deep basin origin for Salina salts through B Salt deposition. — *from* Author's abstract

00291 **Matthews, William H., 3d.** Invitation to geology — The Earth through time and space: New York, Nat. History Press (for Am. Mus. Nat. History), 148 p., illus., 1971.

This "broad-brush" treatment of the more fundamental aspects of the study of the Earth provides the basic essentials of physical and historical geology and shows the relation of Earth to other astronomical bodies. Chapter headings are: an invitation from the Earth, evolution of a science, geology and geologists, planet Earth, portrait of a planet, dynamic Earth, in search of the past, fitting the pieces together (the geologist at work), and geology and the future. Selected readings and an index are appended. — MCM

07130 **Mattson, James S.; Mark, Harry B., Jr.; Weber, Walter J., Jr.** Investigation of optically dense systems by internal reflection spectroscopy — Experimental considerations, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 91-104, illus., 1970.

Many materials of importance in natural waters and waste-water systems — e.g., sediments, suspensions, and precipitates — are optically opaque. In analysis and identification of such materials, for cases in which conventional transmission spectroscopy is not feasible because of scattering effects and/or extensive attenuation of incident light, the technique of internal-reflectance spectroscopy (IRS) often provides a means for obtaining characteristic spectral data. Specific examples presented include active carbons and carbon blacks, marine sediments, freshwater sediments, and extremely turbid suspensions. Experimental considerations involved in application of IRS to such systems are discussed. Interpretation of IRS spectra, and differences to be expected between IRS and transmission spectra are also considered. — *from* Authors' abstract

07386 **Maurer, Robert Eugene.** Geology of the Cedar Mountains, Tooele County, Utah [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2066B, 1970.

07206 **Maxwell, Ross A.; Dietrich, John W.** Correlation of Tertiary rock units, West Texas: Texas Univ. Austin Bur. Econ. Geology Rept. Inv. 70, 34 p., illus., 1970.

Rocks in Big Bend National Park and larger areas to the west and northwest are lower Tertiary sedimentary clastics, and upper Tertiary volcanics from several eruptive centers; the very oldest, found only in the Park, overlap Cretaceous rocks. Dissimilarity in rocks of the same age, and nondeposition or erosion of volcanics confused their stratigraphic correlation, caused multiple nomenclature by early investigators. Some units can be traced by distinctive lithology, others by fossils, lavas by paleomagnetic characteristics; a possible correlation of Tertiary volcanic rocks in the Big Bend region (in pocket) used as datum the Mitchell Mesa-Brite Ash-flow Tuff, an extensive regional marker. The source and geographic distribution of the Canoe Formation, 5 members of the Chisos and 3 of the South Rim Formations are briefly reviewed; sections include younger formations in the Bofecillos, Barilla and central Davis Mts., the Rim Rock Country, and Chinati Mts. — GDC

00277 **Maykut, Gary A.; Untersteiner, Norbert.** Some results from a time-dependent thermodynamic model of sea ice: Jour. Geophys. Research, v. 76, no. 6, p. 1550-1575, illus., tables, 1971.

A one-dimensional thermodynamic model of sea ice is presented that includes effects of snow cover, ice salinity, and internal heating due to penetration of solar radiation. The model is applied to the central Arctic. Values predicted by the model for average ice thickness (288 cm), amount of surface ablation (40 cm), and temperature field all agree closely with field observations. Other results indicate that, under present conditions, the ocean must supply 1 to 2 kcal per cm^2 per yr to the ice; an additional 4 kcal per cm^2 per yr would cause the ice to vanish. Annual snow depths less than 70 cm would result in much thicker ice. Comparison of observed and calculated temperature profiles suggest that about 2.0 to 2.5 kcal per cm^2 per yr of incoming shortwave radiation penetrates the ice and contributes to internal heating. Average ice albedos under 0.50 would cause the ice to vanish in a few years. — *from* Authors' abstract

McAdoo, Gene D. *See* Gabrysch, R. K. 07205

07619 **McAtee, James L., Jr.** Simultaneous X-ray diffraction-DTA [with French, German, and Russian abs.]: Clays and Clay Minerals, v. 18, no. 4, p. 223-232, illus., 1970.

Simultaneous X-ray diffraction-differential thermal analysis equipment for an X-ray diffractometer was evaluated. A brief description of the apparatus and of the method of preparing the sample was given. Simultaneous XRD-DTA was used to study various clay minerals and inorganic hydrates. It was found in the study of clays such as hectorite, montmorillonite, kaolinite, and attapulgite that information concerning the rate of removal of water and hydroxyl units at various temperatures could be correlated to changes in the X-ray diffraction pattern. Various inorganic hydrates such as barium chloride dihydrate, nickel sulfate hexahydrate, and potassium ferrocyanide trihydrate were examined under dynamic and static conditions of analysis along with vacuum conditions. It was found that good correlation could be obtained between the X-ray diffraction pattern and the loss of water from the hydrates as indicated by the DTA curves. — Author's abstract

07236 **McAuslan, E. R.** Boys (Geologists) be careful of probable Tertiary landslide in western Washakie Basin, Wyoming: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 1-6, illus., 1970.

Geological phenomena occasionally exhibit features not apparent from casual observations. A seemingly normal succession of Tertiary rocks in the western Washakie Basin, when measured, proved to be Green River-Laney beds lying unconformably on Wasatch Cathedral Bluffs as a result of an ancient landslide. Therefore, be careful when drawing conclusions based on brief geological examinations. — Author's abstract

07323 **McCarthy, James A.** The Miocene trend of Calhoun and Matagorda Counties, Texas, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 163-175, illus., 1970.

The Miocene Trend in Texas offers the small company or independent operator the exploratory potential to supply a growing demand for interstate gas. Little can be done to overcome some of the well location problems connected with operations within the inland bay of the Big Ranch area, but the growing demand for natural gas and increased marketing facilities have now overcome two of the problems which discouraged development in the past. Regardless of the problems, the Miocene Trend is one of the few places remaining on the Texas Gulf Coast where one can explore for multiple oil and gas reservoirs at depths above 6,500 feet. — DBV

07371 **McCauley, Ronald Arthur.** Crystal chemistry and luminescence of pyrochlores [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2151B-2152B, 1970.

McCullagh, M. J. *See* King, Cuchlaine A. M. 00214

07606 **McGowen, J. H.** Gum Hollow fan delta, Nueces Bay, Texas: Texas Univ. Austin Bur. Econ. Geology Rept. Inv. 69, 91 p., illus., tables, 1970.

Gum Hollow fan delta on the mainland side of Nueces Bay, Texas, has been built in the past 30 years by discharge of a partly artificial drainage system. The fan delta is tri-lobate; the western and middle lobes were active until after Hurricane Carla in 1961. The size and shape of the active eastern lobe resulted from heavy spring rains in 1966 and heavy rains associated with Hurricane Beulah in 1967 and Hurricane Candy in 1968. Under conditions of high discharge due to high rainfall, dispersal on the fan occurs as sheetfloods and the fan aggrades. With normal sea level and low discharge, dispersal is by braided streams and the fan progrades. The delta is reworked by beach, sheet wash and aeolian processes, and consists of four depositional areas — fan plain, distal fan, main channels and prodelta. — *from* Author's abstract

07537 **McGuire, Odel S.** Geology of the Eagle Rock, Strom, Oriskany, and Salisbury quadrangles, Virginia: Virginia Div. Mineral Resources Rept. Inv. 24, 39 p., illus., tables, geol. maps, 1970.

These quadrangles in west-central Virginia, within the Valley and Ridge province, are underlain by Cambrian to Mississippian bedrock ranging and have a stratigraphic thickness of over 20,000 feet. Major structural features are elongate folds with NE-SW trending axes, and faults with the same general strike that typically involve thrust and reverse movement northwesterly. The trace of the Pulaski-Staunton thrust fault arcs from the southwest corner for about 17 miles to the eastern edge, separating outcrop areas of unlike Middle Ordovician facies and different structural styles. There are also transverse faults and associated thrusts, tectonic breccias, and refolded structures. High-calcium and crushed limestone, iron ore, and barite have been mined from the area, only limestone in current production. Other potential mineral resources include dolomite, clay and shale, sand and gravel, coal, and manganese. — *from* Author's abstract

00200 **McKee, Edwin D.; Douglass, John R.; Rittenhouse, Suzanne.** Deformation of lee-side laminae in eolian dunes: Geol. Soc. America Bull., v. 82, no. 2, p. 359-378, illus., tables, 1971.

Processes responsible for structures in sand dunes consist of (1) primary deposition by saltation and creep and by settling from suspension, (2) redeposition accompanying avalanching, and (3) penecontemporaneous erosion. Avalanching is of two types: sand flow and slumping. Nine varieties of deformational structures are recognized. Analysis suggests criteria for distinguishing compressional types (lower dune slope) from tensional types (upper dune slope). The analysis of deformational structures also serves to distinguish between forms developed in cohesive sand and those in noncohesive sand. Since the degree of cohesion is largely a function of the amount of moisture in the sand at the time of avalanching, the deformational structures provide a means for recognizing original dry sand, wet sand, sand crusts, and saturated sand surfaces in ancient deposits. — *from* Authors' abstract

07575 **McKown, David Melvin.** Application of gamma-gamma coincidence counting techniques to the non-destructive activation analysis of meteoritic materials [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1144B, 1970.

07467 **McLean, J. S.** Saline ground-water resources of the Tularosa Basin, New Mexico: U.S. Office Saline Water Research and Devel. Prog. Rept. 561, 128 p., illus., tables, 1970.

In this north-trending, intermontane, desert basin in south-central New Mexico, with no through-flowing streams, runoff from bordering mountains flows into ephemeral lakes in center of basin. Fresh-water supplies are limited, but large volumes of saline ground water underlie most of the basin. Bedrock aquifers from Precambrian through Cretaceous in age, where exposed in the mountains and in the north part of the basin, may yield up to 150 gpm, but usually less than 20 gpm; water quality deteriorates with depth. Alluvial fill of Tertiary to Holocene age, over 6,000 feet thick in the southern part, is the most widely developed aquifer, with well yields of as much as 1400 gpm. Fresh water lenses occur in the fill adjacent to mountains on east and west sides there; the water in the fill increases in salinity with depth and toward center of basin. — GDC

07143 **McManus, Dean A.; Burns, Robert E.; Weser, Oscar; Vallier, Tracy; vonderBorch, Christopher V.; Olsson, Richard K.; Goll, Robert M.; Milow, E. Dean.** Initial reports of the Deep Sea Drilling Project — V. 5, covering Leg 5 of the cruises of the Drilling Vessel *Glomar Challenger*, San Diego, California to Honolulu, Hawaii, April-June, 1969: Washington, D. C., U.S. Govt. Printing Office, 827 p., illus., tables, 1970.

Leg 5 left San Diego, Calif., Apr. 12, 1969, and arrived at Honolulu, June 5, 1969, drilling at sites 32-43 during the cruise. It was designed to sample near fracture zones to investigate the origin of magnetic anomaly patterns and possible relative movement along the zones, and to recover continuous sedimentary sections along a N-S profile. Part 1 comprises shipboard site reports, one chapter for each site, and is cited separately. Part 2, shore laboratory studies, contains 14 chapters, all cited separately. Three chapters, plus 35 pages of hole summaries, comprise the cruise leg synthesis, Part 3, and are cited separately. Three appendices contain: time stratigraphic framework, sample list, and site surveys, not cited separately. — ESL

07144 **McManus, Dean A.** (and others). Sites 32-43, Chaps. 1-13 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 15-418, illus., tables, 1970.

Drilling sites 32-37 were on identified magnetic anomalies close to fracture zones; and sites 37-43 along a N-S profile. Background geology and graphic summaries and photographs of the cores for each site are given. The age of cores is Oligocene, or Miocene, to Pleistocene on the holes near rifts, and Eocene to Miocene on the N-S trend. Lithology and paleontology are discussed. Fossils are primarily calcareous and siliceous nannofossils, foraminifera, and radiolaria. Two of the sites were drilled for comparison across the Mendocino fracture zone; basement could not be reached in one, but sediment comparison across the zone was possible. — ESL

07156 **McManus, Dean A.** Comparison of three methods of measuring or estimating sonic velocity in sediments, Chap. 27 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 545-549, illus., tables, 1970.

Three different methods of determining sound velocity in sediments were used during Leg 5. First, an indirect estimate determined by comparing traveltimes to reflectors with the driller's depth to the lithologic unit causing the reflection. The second method used was an Underwater Systems Laboratory sonic velocimeter reading from the cores still in their plastic liners, comparing traveltime with a standard, a liner filled with distilled water. The third method was down-hole acoustic logging. Data from three sites are selected to illustrate the results: Site 34, to represent sites with thick sediment sections; Site 37, representing a thin sediment section cored to the basement; and Site 35, where the acoustic log was obtained. — ESL

07249 **McManus, Dean A.; Weser, Oscar; vonderBorch, C. C.; Vallier, Tracy; Burns, Robert E.** Regional aspects of Deep Sea Drilling in the northeast Pacific, Chap. 31 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 621-636, illus., tables, 1970.

Many aspects of the drilling results are of a regional nature. Sedimentation rates are based on in situ thicknesses at drill sites, with no correction for compaction. Physical stratigraphy for Sites 32 through 36 is discussed together as they are all near the west coast of North America, and strongly influenced by terrigenous sedimentation. Comparison of the paleontologic age of the basal sediment with the age of the underlying basalt, as inferred from magnetic anomalies, was one of the objectives for drilling sites. Other aspects discussed are the high barium content in sediment north of the Mendocino fracture zone, and the possibility that the amorphous iron-oxide facies apparently formed only at certain times during sea-floor spreading. It is suggested that fracture zones divide the ocean crust into distinctive blocks. — ESL

07229 **McNeal, B. L.; Oster, J. D.; Hatcher, J. T.** Calculation of electrical conductivity from solution composition data as an aid to in-situ estimation of soil salinity: Soil Sci., v. 110, no. 6, p. 405-414, illus., tables, 1970.

Satisfactory agreement between calculated and measured electrical conductivity was obtained by applying a correction factor to the values of EC calculated from the polynomial method. Good agreement was obtained when exponential or linear-segment calculation methods were used. — JWH

07167 **McWilliams, R. G.; Joiner, Thomas J.** Gravity survey of Clarke County, Alabama: Alabama Geol. Survey Circ. 54, 73 p., illus., tables, 1970.

During 1966 a gravity survey of 1,493 gravity stations was made in Clarke County, an area of about 1,250 sq mi. The most significant gravity features are: the Thomasville maximum which reflects a basement high that was above sea level during deposition of the Louann Salt; a large area of low gravity values associated with a salt embayment in the eastern and northeastern part of the county; a minimum associated with the Hatchetigbee anticline; a maximum between Grove Hill and Jackson possibly indicating a heretofore undetected north-northeast graben; and a minimum associated with the Klepac dome. An abrupt change in gravity gradient south of the Thomasville maximum indicates the approximate updip limit of Louann Salt deposition. — *from* Authors' abstract

07169 **McWilliams, Richebourg G., Jr.** Gravity survey of Wilcox County, Alabama: Alabama Geol. Survey Circ. 62, 63 p., illus., tables, 1970.

During 1965 and 1966, a gravity survey consisting of 1,162 gravity measurements was made in Wilcox County over an area of approximately 900 sq mi. Data reflect most known major geologic structures and indicate other features not evident from existing surface or subsurface geologic control. The most significant gravity features are: a maximum in the northern part which indicates a basement high; a wide area of low gravity values in the western part associated with a basement trough in which salt was deposited; a small part of the Thomasville maximum which occurs in Clarke County and extends into the southwest part of Wilcox County; an area of moderately high values between Oak Hill and Fatama which probably indicate a low basement ridge; and a gravity minimum east of Pine Apple which probably indicates a basement low. — *from* Author's abstract

00233 **McWilliams, Robert G.** Reply (to discussion by Robert D. Brown, Jr., of "Evidence for thrust faulting in northern Olympic Peninsula, Washington," 1970): Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 129-131, 1971.

For the paper under discussion, *see* ibid., v. 54, no. 2, p. 344-349, 1970; Abs. North American Geology, August 1970.

07485 **Meade, Lance.** Industrial minerals and the community, an alienation gap, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 225-231, illus., 1970.

The industrial mineral industry, the supplier of raw materials that have enabled our present technically advanced society to develop is faced with possible extinction by this same society. In the name of conservation, zoning, pollution, and beautification, legislative controls are being enacted which will, and already have, seriously limited the supply of many mineral commodities. The general public and the communities which harbor mineral producers are in most cases more aware of possible dust and noise than of the significance of those mineral commodities in their everyday lives. It is suggested that the outside community be educated to the importance of the industry in order to prevent limiting utilization of industrial mineral reserves. — *from* Author's abstract

07161 **Mefferd, M. G.** Murphy area of Las Cienegas oil field: California Oil Fields — Summ. Operations 1970, v. 56, no. 1. p. 5-13, illus., tables, 1970.

In the Morphy area formations ranging in age from Holocene through Jurassic(?) have been logged. The upper Miocene Puente Formation, which attains a thickness of about 2,300 feet near the crest of the structure, contains all of the productive oil sands and is apparently in conformable contact with the lower Pliocene overlying Repetto Formation. The subsurface structure is an asymmetric, northwesterly trending, faulted anticline; transverse faults with displacements from 80-200 feet intersect the zones and divide the area into three separate fault blocks. Production statistics are tabulated. — MCM

07394 **Merrill, Robert H.; Stateham, Raymond M.** Loose rock can be detected by infrared devices: Mining Eng., v. 22, no. 11, p. 59-62, illus., 1970.

Loosened rock in underground mine workings is a serious safety hazard. There are slight temperature differences between solid rock and loosened rock in underground mines because circulating air more readily cools the loose rock. Two new infrared instruments, which can detect temperature differences of 0.2°C, are sensitive enough to help detect loosened rock in mine workings and are therefore useful in mine safety applications. Several practical examples are given. — MAC

00318 **Merrill, Robert K.; Péwé, Troy L.** Sheep Crossing Formation—A new late Cenozoic epiclastic formation in east-central Arizona: Arizona Acad. Sci. Jour., v. 6, no. 3, p. 226-229, illus., table, 1971.

The surficial deposit here named Sheep Crossing Formation is interpreted as extensively eroded remnants of large, coalescing fans on the flanks of ancient Mount Baldy volcano. The poor sorting (clay through large boulders) and crude stratification suggest that mudflows and fluvial activity were the major contributors to the fans, probably during waning stages of volcanic activity. Deep weathering of the boulders suggests that much of the issection of the fans occurred before late Pleistocene time. Ages of older volcanic rocks have not yet been established; however, a late-stage basalt flow overlying the Sheep Crossing in its type section has a K-Ar age of 8.9 ± 0.9 m.y. An unnamed sedimentary formation directly underlying the Sheep Crossing can be correlated with a tentatively Miocene formation near Alpine, Ariz. (Wrucke, 1961). The Sheep Crossing is probably late Miocene. — VMJ

07185 **Meshref, W. M.; Hinze, W. J.** Geologic interpretation of aeromagnetic data in western Upper Peninsula of Michigan: Michigan Geol. Survey Rept. Inv. 12, 25 p., illus., tables, geol. maps, 1970.

The regional structure and lithology of Precambrian formations in parts of Ontonagon, Gogebic, Iron, Baraga, and Houghton counties is interpreted using available geologic data and aeromagnetic maps. The position and attitude of the near-surface contact between the North Trap Range lavas and the Jacobsville Sandstone is uncertain west of longitude 89°20′ W. and may dip southward. A linear magnetic anomaly south of Keweenaw fault may be due to crossfaulting or sliding of the southern part of

the lavas, later buried by sandstone. The Porcupine Mountains may be a lopolithic intrusion of rhyolite. South of Keweenaw fault a linear magnetic source, Middle Trap Range, is possibly an up-faulted block of South Trap Range lavas. South of Barb Lake fault granitic rocks in the center of the Marenisco anticline are probably Early Precambrian. Magnetic strata south of the anticline may be the Ironwood Iron-formation of the Tyler Slate series. — *from* Authors' abstract

Meyerhoff, A. A. *See* Paine, William R. 07314

00319 **Middleton, R.** Turnbull Township, District of Cochrane: Ontario Dept. Mines and Northern Affairs Prelim. Map P.638 (Geophys. Ser.), scale 1 in. to 1/4 mi., text, 1971.

A ground, vertical component magnetic survey was carried out, and the information used to make a map. Bedrock is Archean metavolcanics and metasediments intruded by various igneous rocks. Three main fault systems are interpreted. Quartz veins containing sulfides are common. Five inset maps with a scale of 1 in. to 1 mi are included. — ESL

00320 **Middleton, R.** Godfrey Township, District of Cochrane: Ontario Dept. Mines and Northern Affairs Prelim. Map P.639 (Geophys. Ser.), scale 1 in. to 1/4 mi., text, 1971.

A ground, vertical component magnetic survey was carried out, and the information used to make a map. Bedrock is Archean metavolcanics and metasediments intruded by varied igneous rocks. Three main fault systems are interpreted. One mine produces gold, silver, copper, zinc, and sulfur and another has ore consisting of chalcopyrite, pyrite, and sphalerite. Other occurrences are described. Five inset maps with a scale of 1 in. to 1 mi. are included. — ESL

07497 **Miller, Fred K.** Geologic map of the Quartzsite quadrangle, Yuma County, Arizona: U.S. Geol. Survey Geol. Quad. Map GQ-841, scale 1:62,500, sections, separate text, 1970.

The text delineates the Precambrian rocks (quartz monzonite), Precambrian or Mesozoic (metavolcanic), five units of Paleozoic(?) rocks, seven formations of Paleozoic rocks, Mesozoic(?) continental red beds, Mesozoic or Cenozoic rocks, Cretaceous or Tertiary Livingston Hills Formation, Tertiary(?) rocks, and Tertiary or Quaternary rocks (Basalt of Black Mesa, alluvium, talus), and granitic rocks of the Dome Rock Mountains (age unknown). – MCM

07441 **Miller, R. P.; Hilts, D. E.** Experimental open-pit mine slope stability study, Chap. 9 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 147-167, illus., table, 1970.

An experimental open-pit coal mine excavation has been developed in an area of strip mines about six miles northeast of Centralia, Wash. The purpose was to observe the behavior of cut slopes as excavation proceeded; the highwall of the experimental cut was instrumented to measure face movements and movements at depth behind the face. A detailed geologic map of soil and rock conditions exposed in the highwall was prepared also and continual visual observations were made; instruments used are described and illustrated. The soils and rock comprising the overburden are highly fractured, jointed, and faulted and the experimental pit illustrates the relative unpredictability of slope failures in such structurally complex areas. It did provide an indication of primary contributing factors and of the expectable sequence of events in failure. — VSN

Miller, S. P. *See* Sclater, J. G. 07308

Miller, Stanley L. *See* Friedmann, Nadav. 00295

Milow, E. Dean. *See* McManus, Dean A. 07143

07311 **Minear, John W.; Toksöz, M. Nafi.** Thermal regime of a downgoing slab, *in* Geothermal problems — Symposium, Madrid, Spain, 1969, Proc.: Tectonophysics, v. 10, nos. 1-3 (spec. issue), p. 367-390, illus., tables, 1970.

The thermal regime of a downgoing slab of lithosphere as implied by the global tectonic hypothesis is important for interpreting the geophysical data and for testing the hypothesis. Heat flow, seismic velocities, density, the occurrence of volcanoes and earthquakes are influenced by the temperatures. Using a finite difference solution of the conservation of energy equation, the temperatures in and at the vicinity of a downgoing slab are computed, taking into account ocean-floor spreading rate, adiabatic compression, phase changes, heat sources, and strain heating. Relative effects of these factors and the slab thickness on the temperature field are investigated. Predicted surface heat flow, gravity field, seismic travel-time anomalies, and volcanoes are compared with Tonga-Kermadec and Japan observations. — Authors' summary

Minkin, Jean A. *See* Chao, E. C. T. 07547

Minnick, L. John. *See* Socolow, Arthur A. 07487

07639 **Mishra, D. C.** Crustal model based on aeromagnetic profiles, gravity studies and wave velocities in rocks and crust: Pure and Appl. Geophysics, v. 81, p. 5-16, illus., tables, 1970.

Regional aeromagnetic profiles from India and North America are analyzed. Calculated depths to source of some of anomalies are in good agreement with drilling data. Magnetic bodies more than 5 km below sea level are not usually reflected in gravity maps, whereas shallower ones are. This suggests that the topmost crustal layer must be metasedimentary and the layer below it, quartz-diorite; experimental data on compressional wave velocity variation in granite, quartz-diorite, gabbro, and dunite as a function of pressure and temperature in the light of deep seismic sounding results support this idea. Further increase in compressional wave velocity in the crust can be explained by a change from quartz-diorite to gabbro, and unusually high velocities at the base of the crust in some places by a change from gabbro to dunite. An explanation for origin of granite masses is attempted on the basis of this crustal model. — DBV

Mitchell, R. J. *See* Eden, W. J. 00248

07300 **Monsees, James Eugene.** Design of support systems for tunnels in rock [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2666B, 1970.

Monster, Jan. *See* Perry, Eugene C., Jr. 00273

00331 **Montford, B.; Cribbs, S. C.** The determination of ruthenium by atomic absorption spectrophotometry [with French and German abs.]: Anal. Chim. Acta, v. 53, no. 1, p. 101-108, illus., tables, 1971.

The effects of some 40 ions and various acids on the atomic absorption spectrophotometry of ruthenium solutions have been studied. All produced interference; this was eliminated by the addition of uranium (4 percent w/v), or, in the case of titanium, by distillation of ruthenium tetroxide from oxidizing acid media. Lanthanum(III), strontium(II), hydroxylamine hydrochloride, perchloric acid, sodium sulphite and sodium nitrate proved ineffective as interference suppressors. Uranium(VI) also enhanced the absorbance of ruthenium; the sensitivity for ruthenium (expressed as $\mu g\ ml^{-1}$ for 1 percent absorbance) was found to be 0.88 in presence of uranium, and 1.0 after distillation. Recoveries of ruthenium by distillation were 98 ± 1.5 percent. — Authors' abstract

00255 **Moore, Carleton B.** Meteorites — Earth Sci. Curriculum Proj. Pamph. Ser. PS-10: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 46 p., illus., table, 1971.

Most meteorites probably came from the belt of asteroids between Mars and Jupiter, and are older than the oldest rock from the surface of the Earth. Meteorite falls and

craters are described, and their relation to shooting stars and meteor showers is explained. The three types of meteorites — iron, stony-irons, and stones — are described, and the mineralogy is given. Understanding of the origin of meteorites and the Earth depends on a satisfactory theory for the origin of chondrules in stony meteorites. Carbonaceous chondrites have a high concentration of carbon compounds and water-bearing silicates. Ages of meteorites are best determined by isotope study. The history of the recognition of Barringer Meteorite Crater is reviewed; more than 40 more giant craters have been found, mostly from airphotos. The origin of tektites also is discussed. — ESL

Moore, D. E. *See* Dixon, J. B. 07433

07587 **Moore, Dwight Garrison, Jr.** Geology, mineralogy, and origin of feldspar rocks associated with alkalic carbonatitic complexes, northern Wet Mountains, Colorado [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1351B-1352B, 1970.

07318 **Morgan, Joseph K.** The Central Mississippi Uplift, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 91-109, illus., 1970.

The subcrop of the lower Paleozoic carbonate defines the herein named Central Mississippi Uplift, feature in east central Mississippi which covers more than 1500 sq mi. Several structural and isopachous maps and a Paleozoic paleogeologic map show configuration and age of the Uplift. More than 10,000 feet of Pennsylvanian-Mississippian sediments were removed during Triassic and Jurassic; the southern portion was downwarped during formation of the Mississippi Salt Basin, and its southern extension is deeply buried and unknown. Faulting was previously thought responsible for loss of section along the edge of the Salt Basin; four seismic profiles show this loss is primarily a result of thinning and convergence of beds. Jurassic deposition was affected by the Uplift which served as a source for clastic material. The oil and gas potential of the Uplift and relations between Uplift and Ouachita and Appalachian structural trends are presented. — *from* Author's abstract

00274 **Morgan, W. J.** Convection plumes in the lower mantle: Nature, v. 230, no. 5288, p. 42-43, illus., 1971.

Mantle hotspots are manifestations of convection in the lower mantle which provides the motive force for continental drift. In the model suggested here, about 20 deep mantle plumes bring heat and relatively primordial material up to the asthenosphere, and horizontal currents flow radially away from each. The points of upwelling have unique petrologic and kinematic properties, but the return flow is uniformly distributed through the mantle. Hotspots may come and go and plate migration may radically change plate-to-plate interactions, but the hotspots leave visible markers of their past activity on the sea floor and on continents. The model is compatible with the differences between oceanic islands and oceanic ridge basalts; it suggests a definite chain of events to form the island type of basalt found on Hawaii and parts of Iceland. The gravity and topographic effect should measure the size of mantle flow at each hotspot. — DBV

07282 **Morgenstern, Lillian Nimitz.** The evolution of some rocks west and south of Boston, Massachusetts [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2768B, 1970.

07545 **Morris, William J.** Hadrosaurian dinosaur bills — Morphology and function: Los Angeles County Mus. Contr. Sci., no. 193, 14 p., illus., 1970.

Reconsideration of morphology and function of the bill of hadrosaurian dinosaurs is based on an excellently preserved bill mold of a specimen of *Anatosaurus* cf. *A. annectens* recently discovered in the Upper Cretaceous Hell Creek Formation of eastern Montana. Morphology suggests a filtering function for the bill and adaptation for discharge of fluid and small particles following intake and mastication of plant or invertebrate food. Restorations are shown for skulls of *A. annectens*, *Corythosaurus excavatus*, and *C. intermedius*. — *from* Author's abstract

07588 **Mossler, John Hamilton.** Facies and diagenesis of Swope Limestone (Upper Pennsylvanian) southeast Kansas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1352B, 1970.

Mott, Charles J. *See* Gould, Joseph C. 07190

07538 **Müller, German.** Petrology of the cliff limestone (Holocene), North Bimini, Bahamas: Neues Jahrb. Mineralogie Monatsh. 1970, no. 11, p. 507-523, illus., 1970.

The cliff limestone along the west coast of North Bimini is a lithified dune deposit (eolianite) built up about 1,800 years ago when sea level was lower than now. It consists of three lithologic units (oosparite, lithoclast-bearing biopelsparite, and lithobiopelsparite) which differ considerably in chemical and mineralogical composition, grain size, degree of cementation, cement type, and allochem composition. The mineralogy of the principal cement type clearly indicates a meteoric (freshwater) subaerial diagenetic lithification environment. Most of the cliff was cemented in the vadose zone, but in the lower part, conditions fluctuated between vadose and phreatic. — DBV

Mundorff, M. J. *See* Crosthwaite, E. G. 07532

Murray, B. *See* Rex, R. W. 07147

07259 **Myers, A. T.; Havens, R. G.; Niles, W. W.** Glass reference standards for trace element analysis of geologic material, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 132-137, tables, 1970.

Five glass standards were prepared for quality control of the trace element analysis of rocks. One standard is a blank, and the other four each contain 46 added elements at uniform concentration levels aimed at 500, 50, 5, and 0.5 ppm, respectively. The blank represents the matrix composition approximating an average igneous rock. Preliminary evaluation spectrochemically of the trace element content and homogeneity of these glasses has demonstrated their usefulness as reference standards. — Authors' abstract

07589 **Nabighian, Misac Noubar.** The wedge problem in geophysics [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1353B, 1970.

Nagle, J. S. *See* Fisher, W. L. 07329

Nash, Douglas B. *See* Fanale, Fraser P. 00197

07400 **Neathery, Thornton L.** Geology and mining of low grade talc deposits, Tallapoosa County, Alabama [abs.]: Mining Eng., v. 22, no. 9, p. 45, 1970.

07662 **Nelson, Henry F.; Bray, Ellis E.** Stratigraphy and history of the Holocene sediments in the Sabine-High Island area, Gulf of Mexico, *in* Deltaic sedimentation, modern and ancient: Soc. Econ. Paleontologists and Mineralogists Spec. Pub. 15, p. 48-77, illus., tables, 1970.

In an interdeltaic area of minor sedimentation off the Texas coast, the Sabine-High Island area, 11 lithotypes are defined. These sediments, deposited as five lithofacies on an eroded Pleistocene surface crossed by the Sabine-Calcasieu Rivers channel, are from bottom to top: fluvial or fluvial-deltaic sand confined to the channel; peat confined to the channel and deposited in an environment that transgressed up channel as sea level rose; muddy sediments, accumulated initially in a lagoon or estuary and later in an open marine environment; clean quartz sand initially deposited along a shoreline but later in a shallow marine environment to form Heald and Sabine Banks; and molluscan shell debris accumulated in a marine environment. Data trace the Holocene history from 10,200 yr B.P. to present. Factors controlling distribution of sediments are topography, variation in rate of rise of the sea, and currents. — *from* Authors' abstract

Nelson, J. S. *See* Kruse, G. H. 07442

Nelson, R. A. *See* Einstein, H. H. 07439

07471 **Newall, Geoffrey; Rast, Nicholas.** (editors). Mechanism of igneous intrusion — Liverpool Geol. Soc. Symposium, Liverpool, England, 1969, Proc.: Geol. Jour., Spec. Issue no. 2, 380 p., illus., tables, 1970.

This collection of 21 symposium papers has as its central theme the physical conditions of initiation, ascent, and emplacement of magmas at various levels of the Earth's mantle and crust. Papers by Bridgwater and Coe and by Windley are cited separately. — VSN

07359 **Nicholls, James Watson.** Studies of the volcanic petrology of the Navajo-Hopi area, Arizona [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2066B, 1970.

07254 **Nicholson, Max.** The environmental revolution — A guide for the new masters of the world: New York, McGraw-Hill Book Co., 366 p., illus., tables, 1970.

The object of this book is to demonstrate what constitutes harmony between man and nature and how this harmony may be achieved. Seven imaginary transects of the Earth at various latitudes provide a picture of the global distribution, nature and scale of some principal features of the natural environment and of man's impact upon it. The history of his use, misuse and attempts to preserve the land and its resources in Great Britain and America and the growing conservation movements in those countries are reviewed. The growth from national to international movements, the international agencies involved and their worldwide activities are discussed. A knowledge of the natural ecosystem must precede a multi-disciplined attempt to ameliorate the impact of man upon this system. — EH

Nicol, Alan B. *See* Parry, W. T. 07413

07579 **Nieswand, George Heinz.** The conjunctive use of surface and ground waters in the Mullica River basin, New Jersey — A change constrained linear programming approach [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1262B, 1970.

07220 **Nightingale, H. I.; Bianchi, W. C.** Rapid measurement of hydraulic conductivity changes in slowly permeable soils: Soil Sci., v. 110, no. 4, p. 221-228, illus., tables, 1970.

This article describes a strain gage permeameter with supporting equipment as a laboratory measurement of low saturated hydraulic conductivity of a confined soil layer. Hydraulic conductivities in the range of 10^{-2} to 10^{-5} cm/day can be determined in 2 to 50 minutes. Values of less than 10^{-5} cm/day should be determined with a strip chart millivolt recorder. The support equipment was designed to study the effect of water quality on the time rate of change in hydraulic conductivity of slowly permeable soil material under load conditions. — JWH

Niles, W. W. *See* Myers, A. T. 07259

07230 **Nishita, H.; Hamilton, M.** Spurious thermoluminescence of soils: Soil Sci., v. 110, no. 6, p. 371-378, illus., table, 1970.

Spurious thermoluminescence of six soils differing in physical and chemical characteristics was examined. Oxygen adsorbed on the surface of the luminescent particles appears to be an important causative factor. After exposure to irradiation, the volume glow of every soil increased considerably and the surface glow increased for some soils and decreased for others. — JWH

00282 **Nitecki, Matthew H.** Pseudo-organic structures from the Precambrian Bass Limestone in Arizona: Fieldiana — Geology, v. 23, no. 1, p. 1-9, illus., 1971.

This paper is a preliminary notice of certain pseudo-organic structures from the basal white limestone member of the Proterozoic Bass Limestone, Grand Canyon National

Park. Six kinds of structures are described and illustrated: stromatolites (products of organic growth, but considered sedimentary structures because morphology is not organic); small siliceous concretions of various shapes; very large, flat carbonate concretions; "biscuits" (ovoid, slightly laminated silica bodies, smaller than stromatolites); microscopic, spherical pollen-like brown bodies left as residue when the biscuits are dissolved in hydrofluoric acid); branching structures. Some are very similar to the "organic remains" described by Alf (1959) and Glaessner (1969) but, although it is difficult to ascertain the true nature of these structures, no definite organic morphology can be recognized in them. — VMJ

00312 **Nordin, Carl F., Jr.** Statistical properties of dune profiles: U.S. Geol. Survey Prof. Paper 562-F, p. F1-F41, illus., tables, 1971.

Properties of sand waves formed by subcritical unidirectional water currents are investigated by statistical analyses of records of stream-bed profiles. Records of bed elevation y as a function of distance x along the channel and time records at a fixed point y of the channel were collected in three laboratory flumes. All bed material was fine sand. Continuous analog records were converted to discrete data points and analyzed by digital computer. Analyses show that both records can be approximately represented as stationary Gaussian processes. The Gaussian assumption, together with spectral properties of records expressed by a dimensionless parameter, permits predicting distributions of maximum and minimum values of y between successive zeros of y. These distributions represent probability distributions of depth of local scour and fill due to formation and migration of sand waves, and the parameters that specify distributions relate approximately to flow velocity and depth. — *from* Author's abstract

Nordstrom, C. E. *See* Inman, D. L. 00221

00297 **Northwood, R. P.; Sangrey, D. A.** The vane test in organic soils [with French abs.]: Canadian Geotech. Jour., v. 8, no. 1, p. 69-76, illus., table, 1971.

In situ vane tests were carried out in a number of different muskeg deposits to examine the mechanism of failure and the effect of variation in vane size and speed of testing. The failure mechanism in peat was found to be similar to that in soft clays. The apparent shear strength varied with vane size but was independent of testing speed. There was an optimum vane size of 10 cm diameter. Block samples were obtained from one site for laboratory vane tests to investigate anisotropy in the strength of the peat. *In situ* tests for anisotropy using vanes of varying shape confirmed the laboratory results, and showed that strengths on the vertical plane could be 100 percent higher than those on the horizontal plane. — Authors' abstract

07602 **Nyquist, Laurence Elwood.** The cosmic ray record in the metallic phase of chondrites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1445B-1446B, 1970.

07368 **Obenson, Gabriel Francis També.** Direct evaluation of the Earth's gravity anomaly field from orbital analysis of artificial Earth satellites [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2070B, 1970.

07521 **Odom, I. Edgar; Hiatt, John L.; Kramer, David J.** Potash feldspar in the Franconia Formation, Wisconsin and Minnesota, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 37-47, illus., table, 1970.

Mineralogical data indicate large amounts of potash feldspar in some lithic units of the Franconia Formation in numerous areas of Wisconsin and Minnesota, but less than one percent feldspar is in underlying lithic units of the Wonewac Formation; both formations are primarily sandstone with minor amounts of shale. The Tonah Member of the Franconia contains at least 35 percent feldspar in several areas; feldspar contents of 15-20 percent are also common in portions of the Birkmose and Reno Members. Each feldspar grain is composed of a detrital rounded core with an authigenic overgrowth that crystallized in situ; detrital cores are microcline with

some microperthite; overgrowths are probably orthoclase. Electron-probe microanalysis shows detrital cores contain 15.5-16 percent K_2O and 0.5-1.5 percent Na_2O; overgrowths contain more than 16 percent K_2O and less than 0.1 percent Na_2O. — *from* Authors' abstract

Offield, T. W. *See* Eggleton, R. E. 07552

07186 **Oklahoma Water Resources Board.** Appraisal of the water and related land resources of Oklahoma — Region 7: Oklahoma Water Resources Board Pub. 29, 141 p., illus., tables, 1970.

This popular account of water and related resources of Oklahoma includes information on geology, soils, water quality, ground water, as well as surface water, climatology, economics, recreation, and etc. — MCM

07475 **Olson, Norman K.** Silica sand for glass production in a portion of the Atlantic Coastal Plain, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 3-22, illus., tables, 1970.

The Atlantic Coastal Plain of Virginia, North and South Carolina, Georgia, and northeastern Florida contains immense reserves of silica sand suitable for glass manufacture. Late Cretaceous(,) to late Eocene deposits in the upper Coastal Plain are poorly to moderately consolidated, have generally less uniform grain size, but have fewer ground-water problems. Pliocene-Holocene deposits of the lower Coastal Plain are unconsolidated and commonly well sorted, but the water table is normally at or near the ground surface. The predominantly marine origin of the Tertiary and Quaternary glass sands provides both restriction and uniformity in size range so vital to quality control; chief contaminants are ferric oxide and various heavy minerals. Size, uniformity and purity of raw materials are especially critical in glass melts. — *from* Author's abstract

07158 **Olson, R. K.; Goll, R.** Biostratigraphy, Chap. 29 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 557-567, illus., 1970.

The upper Tertiary biostratigraphy of Sites 32 to 37 consists largely of Foraminifera, ranging in age from late Miocene to Pleistocene. Seven planktonic assemblages, informal biostratigraphic units, are described. Tentative correlations can be made between holes. These units approximate geologic-climate units because most of the assemblages seem representative of water masses with definitive temperature characteristics. The Pleistocene is divided into two parts, preglacial and glacial. Radiolaria were not found at Sites 35-37, and are present in small numbers only for middle Miocene to upper Pliocene. Lower Tertiary biostratigraphy, Sites 38 through 42, is based on Foraminifera and Radiolaria. The former are more broadly distributed on a latitudinal basis than those in the upper Tertiary. Radiolaria were not found at Sites 37-39, but are abundant at 40-42. — ESL

Olsson, Richard K. *See* McManus, Dean A. 07143

Opheim, Lee A. *See* Hogan, Edward Patrick. 07192

Oster, J. D. *See* McNeal, B. L. 07229

07243 **Ostrom, John H.** Stratigraphy and paleontology of the Cloverly Formation (Lower Cretaceous) of the Bighorn Basin area, Wyoming and Montana [with German and Russian abs.]: Yale Univ. Peabody Mus. Nat. History Bull. 35, 234 p., illus., tables, 1970.

Ostrom subdivides the nonmarine strata of the Bighorn Basin between the Late Jurassic Sundance Formation and Early Cretaceous Thermopolis Shale into eight informal lithologic units, based on measured sections, which are compared in detail with

the formal terms Morrison, Cloverly, and Sykes Mountain as inconsistently applied by previous authors. Units 1-3 are considered as Morrison Formation; the few fragmentary vertebrates found in them are referable to well-established Morrison taxa. Unit 8, a basal sandstone, is considered the lower part of Moberly's (1960) Sykes Mountain. Units 4-7 are considered Cloverly Formation; the numerous vertebrates (some fishes, mostly reptiles) are totally distinct from classical Morrison fauna. Age of the Cloverly is probably late Aptian and early Albian. *Ceratodus frazieri*, *Microvenator celer*, *Tenontosaurus tilleti*, *Sauropelta edwardsi* — a new species of dipnoan, and new genera and species of theropod, ornithopod, and ankylosaur, respectively — are described. — VMJ

07422 **Ostrom, Meredith E.; Davis, Richard A., Jr.; Cline, Lewis M.** (Field Trip Committee). Field trip guidebook for Cambrian-Ordovician geology of western Wisconsin — Geol. Soc. America, Ann. Mtg., Milwaukee, Wis., 1970: Wisconsin Geol. and Nat. History Survey Inf. Circ. 11, 131 p., illus., table, 1970.

This field trip is intended to acquaint visitors to the Upper Mississippi Valley with the Lower Paleozoic rocks of the area, and to review the more pertinent changes in interpretation and correlation during the last 20 years. Only selected outcrops in Wisconsin are visited, that demonstrate the principles described; measured sections are presented in the road log. Included in the guidebook, with short histories of the bedrock geology and ice age in Wisconsin, are figured maps showing general distribution of major rock formations, glacial deposits, and the buried Precambrian, a stratigraphic column, and two separately cited papers (M. E. Ostrom; R. A. Davis, Jr.) summarizing historical changes in interpretation and in classification and correlation. — GDC

07423 **Ostrom, Meredith E.** Sedimentation cycles in the Lower Paleozoic rocks of western Wisconsin, *in* Field trip guidebook for Cambrian-Ordovician geology of western Wisconsin — Geol. Soc. America, Ann. Mtg., Milwaukee, Wis., 1970: Wisconsin Geol. and Nat. History Survey Inf. Circ. 11, p. 10-34, illus., table, 1970.

Comprising five sedimentary cycles in the 17 Upper Cambrian-Middle Ordovician rock units of the Upper Mississippi Valley are four recurring lithotopes: basal, thick-bedded, littoral quartzarenites; transition, thinner bedded, poorly-sorted, reworked quartzarenites of the nondepositional shelf; shales or argillaceous sandstones of the depositional shelf; and biogenic carbonates. Deposition, on the craton northwest of the Appalachian geosyncline, was roughly parallel to the shoreline, in zones migrating with fluctuating sea level; the paleoslope remained constant in dip to southeast, sediment transport to south or southwest. Regressive phases unknown in Ordovician cycles suggest active subsidence during shelf emergence at close of the Cambrian. Use of the cyclic hypothesis in Wisconsin helps to explain local and regional stratigraphic relations. — GDC

Otto, N. C. *See* Quinn, J. A. 00278

Overman, R. F. *See* Corey, J. C. 07623

Oversby, Virginia M. *See* Broecker, Wallace S. 00292

07542 **Pabian, Roger K.** Record in rock — A handbook of the invertebrate fossils of Nebraska: Nebraska Univ. Conserv. and Survey Div. Educ. Circ. 1, 99 p., illus., 1970.

Following an introductory discussion on fossils in general, the characteristic of Nebraska's important fossils are described by each phylum — classes of Brachiopoda, Ammonoidea, Gastropoda, Cephalopoda, Arthropoda, Echinodermata, a few vertebrate remains, and plants. A standard geologic time chart, a time-life chart of rocks exposed in Nebraska, Pennsylvanian to Pleistocene, and a small geologic bedrock map of the State are included. Line drawings by Sally Lynne Heald illustrate various specimens, and an appendix lists invertebrate animals, plants and fishes that have been collected in Nebraska. Phyla are here arranged alphabetically with numbered references and age indications; generic names are used as they were by authors of references. — GDC

Page, Benjamin M. *See* Keen, Myra A. 00264

07262 **Palloor, Govind.** Variations in cation exchange capacities of some representative Michigan soils with analytical procedures and their relationships to acidity, clay mineralogy and organic matter [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2413B-2414B, 1970.

07314 **Paine, William R.; Meyerhoff, A. A.** Gulf of Mexico basin — Interactions among tectonics, sedimentation, and hydrocarbon accumulation, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 5-44, illus., table, 1970.

The Gulf of Mexico is an oceanic basin in which is found 5 to 10 times the normal sedimentary thickness on oceanic crust. It has been oceanic for a long period of geologic time and is not a subsided continental block. The Gulf of Mexico oceanic plate dips northward, with differential scissors movement between it and its eastern and western flanks (the Tamaulipas, Yucatan, and Florida platforms). The Gulf Coast geosyncline developed on the Texarkana platform underlain by Arbuckle facies, in at least the late Paleozoic. The structural development of the northern and southern sides has been very different from that of the eastern and western flanks. Various prospective areas are mentioned. — DBV

Panda, P. K. *See* Verma, R. K. 07309

07539 **Parham, Walter E.** Clay mineralogy and geology of Minnesota's kaolin clays: Minnesota Geol. Survey Spec. Pub. Ser. SP-10, 142 p., illus., tables, 1970.

Weathering of Precambrian rocks, probably in early Late Cretaceous, produced a thick kaolinitic residuum over much of Minnesota, in places up to 100 feet thick. It is covered by Cretaceous sedimentary rocks and Pleistocene gravels except locally in southwestern and central Minnesota. Weathering of felsic rock types produced kaolinite, in the least weathered parts of the profile, of irregular platyform and some tubular halloysite. Mafic rock types are weathered to montmorillonite and kaolinite. A lower unit of Upper Cretaceous sedimentary rocks overlying the residuum and composed of kaolinite, quartz, and trace amounts of halloysite, i disconformably overlain by organic-rich clays and shales, thin lignite beds, and a thin bentonite bed, with abundant kaolinite in the basal part grading upward into montmorillonite and illite. Some kaolinitic clays from all three units could be used for ceramics or refractories, and some from the residuum and Lower Cretaceous for the paper industry. — *from* Author's abstract

07411 **Parizek, Richard R.** Prevention of coal mine drainage problems by well dewatering [abs.]: Mining Eng., v. 22, no. 9, p. 54, 1970.

07369 **Parry, John Robert.** Integral equation formulations of scattering from two-dimensional inhomogeneities in a conductive earth [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2070B, 1970.

07413 **Parry, W. T.; Nicol, Alan B.** A tiltmeter to measure minute rotational movement: Mining Eng., v. 22, no. 9, p. 71-73, illus., 1970.

A sensitive tiltmeter has been developed which can be used as a warning device to detect earth movements before any signs of failure are visible. This instrument can also be used to gather data on the mechanism of landslides. Three examples of the practical use of the tiltmeter are described. — MAC

Patchen, Douglas G. *See* Cardwell, Dudley H. 07199

00249 **Paul, M. J.** The mechanics of landslides in Leda clay — Discussion [of paper by W. J. Eden and R. J. Mitchell, 1970]: Canadian Geotech. Jour., v. 8, no. 1, p. 143-148, illus., 1971.

The original paper was published ibid., v. 7, no. 3, p. 285-296, 1970; *see* Abstracts of North American Geology, March 1971. — ESL

07464 **Pearson, F. J., Jr.; Friedman, Irving.** Sources of dissolved carbonate in an aquifer free of carbonate minerals: Water Resources Research, v. 6, no. 6, p. 1775-1781, illus., tables, 1970.

Water from 14 wells in the Magothy aquifer, Long Island, New York, was sampled for chemical analysis and C-13:C-12 ratio measurements of the dissolved carbonate. The Magothy is essentially free of carbonate minerals and contains water whose chemistry is controlled by the chemistry of the atmospheric precipitation that recharged the aquifer. Wells near the recharge area have δC-13 values of -25 percent and total carbonate contents corresponding to a pressure CO_2 4×10^{-3} atmosphere, showing that the carbonate here is derived from the soil zone. Downgradient, the total carbonate doubles, but the δC-13 values remain more negative than -18 percent. The dissolved carbonate increase is due in part to carbonate mineral solution, but results largely from oxidation of lignite in the aquifer by oxygen dissolved in the water. — Authors' abstract

07209 **Peirce, H. Wesley; Keith, Stanton B.; Wilt, Jan Carol.** Coal, oil, natural gas, helium, and uranium in Arizona: Arizona Bur. Mines Bull. 182, 289 p., illus., tables, geol. map, 1970.

Purposes of this report are to assist in developing an understanding and geological perspective of the occurrence of coal, petroleum, natural gas, helium, and uranium in Arizona, and also to serve as the base for continuing efforts for the orderly development of these and other natural resources. Nineteen plates in pocket include a geologic map of the Black Mesa, sections, isopach maps of Cambrian, Devonian, Mississippian, Pennsylvanian, and Permian systems, and uranium occurrences. For each part (coal; oil, natural gas, helium; uranium) a unified bibliography for each commodity is appended. — MCM

00273 **Perry, Eugene C., Jr.; Monster, Jan; Reimer, Thomas.** Sulfur isotopes in Swaziland system barites and the evolution of the Earth's atmosphere: Science, v. 171, no. 3975, p. 1015-1016, table, 1971.

Sedimentary barites from the Swaziland System of South Africa (more than 3,000 million years old) have sulfur-34 ratios that are enriched by only 2.5 per mil with respect to contemporary sulfides. To explain this small fractionation, it is proposed that oxygen pressure in the Earth's atmosphere was very low and that local oxidation occurred in a photosynthetic layer of the ocean. — Authors' abstract

Perry, R. M. *See* West, L. J. 07454

00199 **Peterman, Zell E.; Hedge, Carl E.** Related strontium isotopic and chemical variations in oceanic basalts: Geol. Soc. America Bull., v. 82, no. 2, p. 493-499, illus., 1971.

Sr-87/Sr-86 values in oceanic basalts range from 0.7012 to 0.7057 and correlate roughly with the $K_2O/(Na_2O + K_2O)$ ratio. The grouping of oceanic basalts into ocean ridge tholeiites, island tholeiites and alkali basalts, and potassic island basalts is in agreement with the relationship. A study and interpretation of the nearly 90 high quality analyses favors a heterogenous mantle with the potassic lavas representing the most primitive variety sampled by young oceanic volcanism. — *from* Authors' abstract

07428 **Petersen, G. W.; Ranney, R. W.; Cunningham, R. L.; Matelski, R. P.** Fragipans in Pennsylvania soils — A statistical study of laboratory data: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 719-722, illus., table, 1970.

Fragipan horizons were contrasted with nonfragipan horizons from comparable depths to determine statistically soil properties related to fragipan occurrence, primarily developed from unconsolidated transported parent materials. Data were analyzed from 773 samples from 254 soil profiles. Fragipan bulk densities of the < 2-mm material were significantly higher in the 1 percent level than nonfragipan horizons within till and fluvial parent materials, but were not significantly different within eolian and lacustrine deposits. Multiple regression analyses indicated no rela-

tionship between 16 soil variables and bulk density. Most fragipans, loam and silt textured, were less leached and less weathered than nonfragipan soils, and had significantly lower organic carbon, lower Ca:Mg ratios, and higher mean base saturations with less alteration of illite to vermiculite. — GDC

Peterson, N. V. *See* Bowen, R. G. 07188

Pewe, Troy L. *See* Merrill, Robert K. 00318

00290 **Pflieger, William L.** A distributional study of Missouri fishes: Kansas Univ. Mus. Nat. History Pub., v. 20, no. 3, p. 225-570, illus., tables, 1971.

Distribution patterns of Missouri fishes, 191 species, are interpreted in terms of environmental conditions and historical factors. The fishes are placed in seven faunal groups: the four primary groups have distributions centered in the Ozark Uplands, Southeastern Lowlands, Osage and Dissected Till plains, Missouri and Mississippi Rivers; the three secondary groups include more widespread species. The late Tertiary fish fauna of Missouri is interpreted as resembling the modern fauna of the southeastern U.S. coastal plain. Pleistocene glaciation, and resulting drainage changes and sea-level fluctuations, had profound effects on the fish fauna, displacing species ranges southward and causing alternate dispersal and isolation of some species. Postglacial climatic fluctuations have resulted in some minor adjustments in ranges. Distribution and habitat in Missouri and zoogeography are discussed for each species, and distribution and range maps are compiled for each. — VMJ

07231 **Phillips, R. E.; Ellis, J. H.** A rapid method of measurement of diffusion coefficients in aqueous solutions: Soil Sci., v. 110, no. 6, p. 421-425, illus., table, 1970.

This paper describes a rapid and simple method of measuring diffusion coefficients in aqueous solution. It also presents the measured diffusion coefficients of several ions in an aqueous solution. — JWH

Phillips, R. E. *See* Ellis, J. H. 07624

00256 **Philpotts, A. R.** Immiscibility between feldspathic and gabbroic magmas: Nature Phys. Sci., v. 229, no. 4, p. 107-109, illus., table, 1971.

Although several examples of possible liquid immiscibility in rocks have been described, most lack any definite proof of such a phase relationship. Field and experimental evidence presented here indicates that the ocellar texture found in some alkaline rocks would result from liquid immisicibility. Although the features described are small-scale, the coalescence of ocelli in the upper parts of sills demonstrates that larger bodies of feldspathic rock can be formed from these blebs. The striking similarity in composition and mineralogy of the feldspathic bodies in large plutons to those of ocelli suggests that they could also be formed from immiscible feldspathic magmas. — DBV

Phukan, K. Y. Lo. *See* Tamuly, A. L. 07443

07398 **Pickard, Greenleaf W.** Geology of the Prieta mine, Parral, Chihuahua [abs.]: Mining Eng., v. 22, no. 8, p. 37, 1970.

07661 **Piwinskii, A. J.; Martin, R. F.** An experimental study of equilibrium with granitic rocks at 10 kb: Contr. Mineralogy and Petrology, v. 29, no. 1, p. 1-10, illus., tables, 1970.

An investigation of rates of reaction in granite-water systems was undertaken at 10 kb pressure using five chemically-analyzed calc-alkaline rocks and two haplogranitic compositions in the system $KAlSi_3O_8 = NaAlSi_3O_8$-SiO_2. Production of melt in the Sierra Nevada granite, granodiorite, and tonalite was determined at 665° C as a function of time. At least three hours seem necessary to develop a constant amount of melt in the granite and granodiorite; the tonalite requires at least 24 hours. In reversal runs from 665° C (hyper-solidus) to 620° C (subsolidus), between 7 and 18 days

are required to completely crystallize the granitic glasses. Composition and structural state of coexisting alkali feldspars from reversal runs on the hypersolvus granite further suggest that 18 days are insufficient to attain a tentative equilibrium state. — Authors' abstract

07175 **Polizzi, Nicholas T.** The effect of sanitary landfill on urban space — Preliminary findings [abs.]: Assoc. Pacific Coast Geographers Yearbook, v. 32, p. 185-186, 1970.

07176 **Pond, Richard B.** The perception of earthquake hazard at Tehachapi, California [abs.]: Assoc. Pacific Coast Geographers Yearbook, v. 32, p. 187, 1970.

00276 **Porter, Christopher R.; Carothers, James E.** Formation factor-porosity relation derived from well log data: Log Analyst, v. 12, no. 1, p. 16-26, illus., tables, 1971.

Data derived from deep induction-density log combination in shallow invaded water sands has been averaged and combined to define an in-place factor-porosity relation (F). A total of 2,295 formation factors were calculated and plotted; data from 11 wells from offshore California Pliocene and four wells from offshore Texas-Louisiana Miocene were used and F calculated for each. Plots are presented from all wells from the Pliocene and Miocene, with a combination data plot from all wells in each geological province. It is concluded that reliable formation factor-porosity relations can be defined using well log data. Care should be exercised in the transfer of these relations from one geological province to another. — *from* Authors' abstract

07253 **Portmann, Jean-Pierre.** Présence de moraine de fond à Poste-de-la-Baleine (Nouveau-Quebec) [Presence of till at Poste-de-la-Baleine (Great Whale), New Quebec]: Cahiers Geographie Quebec, v. 14, no. 32, p. 243-251, illus., 1970.

On the south bank of the Great Whale River about 10 km upstream from its mouth on Hudson Bay, is an interesting contact of what is interpreted as till (bottom moraine) containing striated pebbles, with underlying very compact marine clay containing abundant shells C-14 dated at 6,280 ± 390 yr B.P., that forms the bed of the river; strandline exposures of the basal clay show a polished surface with two generations of striae or grooves and transverse fissures filled with sand and fine gravel. In one section of the bank, an elliptical structure about 12 m long consists of clay folded into a small anticline, eroded, and planed. Islands immediately downstream can be considered remnants of end moraine; in this section, the river bed is shallow and strewn with pebbles and boulders. All observed features indicate a former glacier as agent rather than seasonal ice. — VMJ

07315 **Powell, L. C.; Woodbury, H. O.** Possible future petroleum provinces of the United States western Gulf basin — Pleistocene [abs.], *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 63-65, illus., 1970.

Hydrocarbons have been found in Pleistocene sediments in 56 fields, mainly offshore from Louisiana, and the western Gulf basin has potential for significant reserves in the Pleistocene. The greatest potential is an area of 15,000 sq mi on the outer continental shelf offshore from Louisiana and Texas, where the neritic interbedded sandstone and shale facies is from 3,000 to more than 8,000 feet thick. Economic operations are technologically possible over most of the continental shelf; however, major reserves are required to justify expensive operations in the deep-water area. — DBV

07152 **Presley, B. J.; Goldhaber, M. B.; Kaplan, R. I.** Interstitial water chemistry, Deep Sea Drilling Project, Leg 5, Chap. 21 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 513-522, tables, 1970.

The data presented are of a descriptive nature only, to give added information on the cores and environment of deposition. A small volume of water was available for analysis, but results are in good agreement with those from Woods Hole. Exceptions are discussed, and improved techniques may help eliminate these differences in future

studies. Maximum changes are seen to occur in magnesium, calcium, potassium, sulfate, and dissolved carbonate. Total salinity shows little variation over that in sea water. There is no obvious membrane filtration effect with depth. Lithium appears to be highly enriched at depth, but only in cores containing terrigenous sediments. Manganese is enriched in many samples, randomly distributed. — *from* Authors' summary

07644 **Presley, Bobby Joe.** Chemistry of interstitial water from marine sediments [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 2, p. 762B, 1970.

07177 **Price, Larry W.** Relationship between vegetation and permafrost on different slopes in a subarctic alpine tundra environment [abs.]: Assoc. Pacific Coast Geographers Yearbook, v. 32, p. 187, 1970.

07268 **Price, Larry Wayne.** Morphology and ecology of solifluction lobe development, Ruby Range, Yukon Territory [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2758B-2759B, 1970.

07509 **Price, Neville J.** Laws of rock behavior in the Earth's crust, Chap. 1 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 3-23, illus., 1970.

A brief discussion is given of experimental aspects of rock mechanics pertinent to more detailed discussion of the mode of behavior of rock in the crust. It is concluded that rock is a solid with complex rheological properties affected by temperature, total confining pressure, pore-fluid pressure, effective differential stress, and strain rate. Experimental deformation has shown that yield strength decreases with temperature and probably is of little significance at or above half the melting temperature; when water occurs freely in pore spaces, effects of temperature and confining pressure on deformation decline. Once yield strength is exceeded, failure may be brittle or ductile, and the type is controlled by temperature, strain rate, and ratio of fluid pressure to total confining pressure. Maximum differential stress which can be obtained is probably about 1 kb. The range of strain rates is great, and the action of fluids during deformation is of paramount importance. — VSN

Proctor, Cleo V., Jr. *See* Fisher, W. L. 07329

07193 **Pryor, Robert.** Formation of a deep-water submarine canyon head in the Tongue of the Ocean [with Spanish summ.]: Bull. Marine Sci., v. 20, no. 4, p. 813-329, illus., table, 1970.

The Tongue of the Ocean branch of Great Bahama Canyon heads in deep water off Fresh Creek, Andros Island. To the south the trough is U-shaped and the site of active sedimentation; to the north it is V-shaped and apparently nondepositional. These sedimentary regimes, as interpreted from particle-size analysis of 11 graded beds from cores taken along the axis of the Tongue, result from an abrupt change in axial slope, which affects the dynamics of turbidity-current flow. Interpretation of profiles of 10 seismic reflection lines which were run in the canyon head area indicates that the break in slope, and position of the canyon head, is localized by coalescence of slump deposits from the canyon walls in the narrowest portion of the Tongue, which is east of Fresh Creek. — *from* Author's abstract

00278 **Quinn, J. A.; Otto, N. C.** Carbon dioxide exchange at the air-sea interface — Flux augmentation by chemical reaction: Jour. Geophys. Research, v. 76, no. 6, p. 1539-1549, illus., 1971.

The stagnant film model for transport of CO_2 across the air-sea interface has been reexamined. By incorporating the constraint of electroneutrality, equations are derived that govern flux of carbon containing species within the film. Electroneutrality obviates the incorrect assumption of constant pH that is implicit in previous exchange calculations. Numerical results for typical ocean conditions indicate that for film thicknesses less than, say, 400 μ, oceanic exchange is not influenced by

hydration/dehydration reactions of dissolved carbon dioxide. This conclusion is in substantial agreement with the approximate analysis of Bolin [1960]. However, if suitable catalysts are present in the ocean [Berger and Libby, 1969], the accelerated reactions are capable of augmenting the exchange rate by a considerable amount. The extent of this enhancement can be predicted by the model presented here. — *from* Authors' abstract

Ragland, Paul C. *See* Fullagar, Paul D. 00205

07316 **Rainwater, E. H.** Stratigraphy and petroleum potential of Peninsular Florida and southern Georgia, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 49-59, illus., 1970.

Cretaceous and Tertiary sediments are present under the area south of the Appalachian Piedmont belt; early Paleozoic sandstone and shale underlie northern Peninsular Florida and southernmost Georgia; Triassic continental deposits with diabase sills and dikes occupy grabens under parts of the Georgia coastal plain and northern Florida; and Jurassic terrigenous clastics, carbonates, and evaporites probably occur on the western and southern flanks of the Peninsular Arch. Cretaceous and Tertiary rocks are mostly carbonates; anhydrite is abundant in the Lower Cretaceous and Paleocene; sandstone and shale occur throughout the section near the northern edge of the Georgia coastal plain. Deposition was in shallow marine environments on a slowly subsiding shelf; after Lower Cretaceous time there was little sediment from the Appalachians. — DBV

07322 **Rainwater, E. H.** Regional stratigraphy and petroleum potential of the Gulf Coast Lower Cretaceous, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 145-157, illus., 1970.

Lower Cretaceous sediments are the most widespread and have the greatest volume of any major Gulf Coast stratigraphic division; an area of 83,000 sq mi is presently productive of oil and gas. Depositional conditions favored development and preservation of vast amounts of hydrocarbon source materials and formation of many reservoir rocks and stratigraphic-structural traps. Environmental analysis of each stratigraphic unit indicates a very large petroleum potential. Many accumulations will be found in the prospective belt on land and under the continental shelf from Mississippi to Florida in deltaic sandstones, carbonate reefs, and shell mounds. In a speculative belt of coastal and offshore Louisiana the objectives are limestone reefs on the landward side of positive blocks. New fields will be found in the productive belt and producing fields will be extended laterally and in depth. — DBV

Rambo, John T. *See* Hearst, Joseph R. 07218

Ramspott, Lawrence D. *See* Braun, Robert L. 07200

07291 **Ranalli, Giorgio.** Rheological properties of rocks as inferred from the study of earthquake aftershock sequences [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2773B, 1970.

07493 **Ranere, Anthony J.** Prehistoric environments and cultural continuity in the western Great Basin: Tebiwa, v. 13, no. 2, p. 52-[73], 1970.

Cultural continuity of early man in the western Great Basin, from latest Pleistocene to historical time, is interpreted from evidence of climatic and pluvial-lake-stage fluctuations, natural and cultural stratigraphy of caves and rock-shelters, and ethnography. Three cultural patterns, lake-shore, desert, and grassland, are traced back to origin early in the Anathermal climatic stage (about 10,000 B.C.). Emphasis is on the lake-shore ecosystem as it is found in the Lahontan Basin of western Nevada. Some radiocarbon dates on cave deposits, plant and other organic remains, and artifacts are cited and interpreted. — VMJ

07417 **Rango, Albert.** Possible effects of precipitation modification on stream channel geometry and sediment yield: Water Resources Research, v. 6, no. 6, p. 1765-1770, illus., tables, 1970.

Stream channel geometry data were collected on 18 small watersheds in the West and sediment yield data were obtained for 673 small watersheds across the United States. Regression analysis was used to test precipitation modification of these watershed parameters. No consistent changes of stream channel geometry between watershed areas were obtained, but results indicate that the stream channel at a given location would adjust significantly to increases in precipitation. This would probably initiate increased channel erosion. Sediment yield will increase substantially in semiarid regions with increasing precipitation up to a mean annual 27 inches; then resulting vegetation growth will begin to reduce sediment yield. Significant changes in stream channel geometry and sediment yield may result in sufficient economic damage to nullify many beneficial effects of weather modification. — *from* Author's abstract

Ranney, R. W. *See* Petersen, G. W. 07428

00252 **Rapp, George, Jr.** Color of minerals — Earth Sci. Curriculum Proj. Pamph. Ser. PS-6: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 30 p., illus., table, 1971.

If there is no light, there is no color, so the study begins with the nature of light and color, and reviews early studies on them. Discussion of the interaction of light with crystals is divided into reflection, refraction, scattering, and absorption. To understand color development in crystals, the electronic structure of atoms must be understood, and the principles involved are reviewed. Sources of color in minerals involve transition elements. The electronic configuration of the first 36 elements is tabulated. Chemical bonding; color centers (imperfections); and reflectivity, luster, and luminescence are discussed. — ESL

Rast, Nicholas. *See* Newall, Geoffrey. 07471

07221 **Ratliff, L. F.; Allen, B. L.** The mineralogy and genesis of two soils from Trans-Pecos, Texas: Soil Sci., v. 110, no. 4, p. 268-277, illus., tables, 1970.

The two soils studied, tentatively named Musquiz and Kokernot, have developed from trachyte and rhyolite in the Davis Mountains. The clay mineralogy of both soils is very similar, except for the increase in montmorillonite in some of the Musquiz substrata. However, this difference seems to be depositional rather than pedogenic. The author believes that these soils are not of eolian origin even though there is some evidence. — JWH

07594 **Reddell, Donald Lee.** Dispersion in groundwater flow systems [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1381B, 1970.

07631 **Reddell, Donald Lee; Sunada, Daniel K.** Numerical simulation of dispersion in groundwater aquifers: Colorado State Univ. Hydrology Paper 41, 79 p., illus., 1970.

A fundamental flow equation derived for miscible fluids in ground water involves two dependent variables, pressure and concentration, the latter determined by a continuity equation for the dispersed tracer. The problem was formulated on a microscopic basis and averaged over a cross-sectional area of porous medium to give a macroscopic convective-dispersion equation. The two equations were solved numerically on the computer, using the method of characteristics with a tensor transformation for the dispersion equation. The proposed simulator solved both longitudinal and lateral dispersion problems, and, with the tensor transformation, successfully solved them in a rotated coordinate system. Using the simulator to solve the salt-water intrusion problem, numerical results for the fresh-water head of the aquifer closely matched those obtained analytically; those for the location of the fresh-salt interface were good except around the wedge toe. — GDC

07340 **Reeves, Richard Wayne.** Modern channel entrenchment in the Coastal Ranges of central and southern California [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2053B-2054B, 1970.

00329 **Reger, Richard D.; Batchelder, George L.** Late Pleistocene molluscs and a minimum age of Meteor Crater, Arizona: Arizona Acad. Sci. Jour., v. 6, no. 3, p. 190-195, illus., tables, 1971.

The age of Meteor Crater has been estimated at less than 5,000 years by Barringer (1905) and others, and between 40,000 and 75,000 years by Blackwelder (1933). An assemblage of late Pleistocene nonmarine mollusks collected from silty sand overlying basal gravel of fluvial terraces along Walnut Creek at Winona, 25 miles northwest of Meteor Crater, is nearly equivalent to fossil mollusks from lake beds in the crater; both assemblages are distinct from the modern Walnut Creek fauna. At Winona, organic carbon two inches above the sand-gravel contact was C-14 dated at 10,785 ± 360 yr; the nature of the facies change and analysis of habitat preferences of the fossil mollusks compared with modern species indicates a major change to warmer, drier climate in northern Arizona about 11,000 years ago; corresponding changes indicate that most of the Meteor Crater lake beds were deposited before 11,000 years ago. — VMJ

07195 **Reid, John R., Jr.** Geomorphology and glacial geology of the Martin River Glacier, Alaska [with French and Russian abs.]: Arctic, v. 23, no. 4, p. 254-267, illus., 1970.

The terminal 17 km of the Martin River Glacier and its periphery offer insight into a dynamic system involving landforms, water, plants, and animals, all directly dependent upon the glacier regimen. The active Ice Zone is the most extensive. The Intermediate and Terminal Zones are characterized by forest and brush-covered superglacial drift; ice sinkhole depressions and lakes are common and may drain suddenly via englacial and subglacial channels. Occasional clear lakes are present in the Terminal Zone where ice may lie beneath only 1-2 m of superglacial drift, sufficient to protect lake water from cold ice and allow successful propagation of aquatic fauna; trees indicate the zone was glacially active about 1650 A.D. The outermost terminal moraine and numerous moraine segments in the Glaciated Zone, are probably of late Wisconsin age, can be traced to the upper 14 lateral moraines in the valley of the Charlotte Lobe. Soils in the lower 7 moraines are probably of Neoglacial age. — *from* Author's abstract

Reimer, Thomas. *See* Perry, Eugene C., Jr. 00273

07434 **Reneau, R. B., Jr.; Fiskell, John G. A.** Selective dissolution effects on cation-exchange capacity and specific surface of some tropical soil clays: Soil Sci. Soc. America Proc., v. 34, no. 5, p. 809-812, illus., tables, 1970.

Changes in CEC and specific surface of clays are statistically reported from 8 Panama soils and Wyoming bentonite after sequential dissolutions of Fe, Al, and Si. Dithionite-citrate treatment resulted in small increase in CEC at pH 4.8 and 9.2, and decrease in ethylene glycol retention; free Fe_2O_3, 2 to 9 percent of clay weight, and substantial Al_2O_3 and SiO_2 were removed. Further treatment, after 2 min with hot 0.5*N* NaOH, resulted in 20-40 percent loss in clay weight as SiO_2 and lesser amounts of Al_2O_3 and Fe_2O_3. An increase of 7 meq in CEC at both pH ranges of soil clays and 20 meq for bentonite was attributed to removal of blocking interlayer material, with sharp decrease in specific surface and loss in clay weight of 9 to 17 percent with $SiO_2 > Al_2O_3 > Fe_2O_3$. The siliceous nature of dissolved materials suggest removal of Al and Fe by illuviation promoted by high organic matter content and humid tropical conditions. — GDC

07147 **Rex, R. W.; Murray, B.** X-ray mineralogy studies, Chap. 16 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 441-483, illus., table, 1970.

Differences between California turbidite contributions and eolian and hydrogenous pelagic sediments may be more complex than predicted. K-feldspar is restricted to turbidite sediments, plagioclases are very abundant, and clay minerals are of major importance on slopes of abyssal hills. In Escanaba trough, mineral assemblages are uniform. Between Mendocino and Pioneer fracture zones, a chloritic zone occurs,

which may be a massive turbidite, and could be a marker. There is no systematic covariance between plagioclase and quartz just north of the Murray zone. Abundant phillipsite between Molokai and Murray zones may be altered volcanic ash. Between Clarion and Clipperton fracture zones, crystalline components of sediments are more than 90 percent calcite. On the outer slope of the Hawaiian arch, cores show greater mineralogic complexity. — ESL

Rex, R. W. *See* vonderBorch, C. C. 07155

07576 **Reynolds, Michael Anthony.** A study of the age of the elements [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1144B, 1970.

07333 **Rezak, Richard.** Experiments in calcium carbonate cementation, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 285-286, 1970.

It is not possible to understand the complexities of carbonate cementation until all factors that affect the process are considered. The organic chemistry of the solutions must be examined in addition to the physicochemical parameters. This paper is a progress report calling attention to experiments in which carbonate sediments have been cemented in the laboratory under ambient temperatures and pressures. Two different kinds of cement have been created, one under strictly inorganic conditions and the other by addition of an amino acid to the solution. — DBV

07628 **Rhoades, J. D.; Ingvalson, R. D.; Hatcher, J. T.** Adsorption of boron by ferromagnesian minerals and magnesium hydroxide: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 938-941, illus., tables, 1970.

Arid-zone soils are found to have appreciable boron-sorption capacities in their silt and sand fractions. The site of this sorption is hypothesized to be magnesium-hydroxy clusters and coatings that exist on the weathering surfaces of ferromagnesian minerals such as olivine, enstatite, diopside, augite, tremolite, and hornblende as well as micaceous layer-silicate minerals. — Authors' abstract

07360 **Rhodes, Rodney Charles.** Volcanic rocks associated with the western part of the Mogollon Plateau volcano-tectonic complex, southwestern New Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2066B-2067B, 1970.

07283 **Richards, Paul Granston.** A contribution to the theory of high frequency elastic waves, with applications to the shadow boundary of the Earth's core [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2769B, 1970.

07374 **Ridlon, James Barr.** Bathymetry and structure of San Clemente Island, California, and tectonic implications for the southern California continental borderland [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2154B, 1970.

Riley, D. L. *See* Herzenberg, C. L. 07134

07306 **Rinehart, John.** Heat flow from natural geysers, *in* Geothermal problems — Symposium, Madrid, Spain, 1969, Proc.: Tectonophysics, v. 10, nos. 1-3 (spec. issue), p. 11-17, illus., 1970.

A natural geyser is a mechanism that extracts heat from the earth. Trapped meteoric water is heated and then thrown clear of its reservoir as hot water or steam, carrying heat with it. There are two basic types of geysers: columnar, discharging quantities of hot water; and pool, in which the eruption consists of a series of detonating steam explosions. Results of temperature measurements made deep within several geysers permit calculation of their respective approximate rates of heat extraction. Old Faithful, which discharges large quantities of water, extracts heat at the approximate rate of 1.34×10^6 cal/sec. Narcissus, an explosive type geyser, develops power at the approximate rate of 3.3×10^5 cal/sec, and Solitary, another explosive geyser, at the rate of 6.4×10^5 cal/sec. — Author's summary

00227 **Rittenhouse, Gordon.** Pore-space reduction by solution and cementation: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 80-91, illus., 1971.

Pore space in water-wet sandstones containing hydrocarbons is reduced by solution of grains at points of contact and by precipitation of resulting cements, but amounts of such cements cannot exceed amounts of material dissolved. Maximum cement-to-solution ratios of porosity loss, calculated for spheres and other geometric forms in various packing arrangements, indicate the ratio is greatest with spheres in orthorhombic packing, rotated 30° (equivalent to a sandstone made up of well-sorted, very well-rounded grains). Cements in excess of maximums calculated would have been introduced before hydrocarbons accumulated. The data apply in both the gas expansion method and the quartz-diagenesis method of determining the time of hydrocarbon accumulation, as both methods require knowing the amount of post-accumulation cement. However, the possibility of nonuniform solution and cementation must be considered. — BHK

00228 **Rittenhouse, Gordon.** Mechanical compaction of sands containing different percentages of ductile grains — A theoretical approach: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 92-96, illus., 1971.

In sandstones, pore space and thickness reduction results from compaction by rotation, fracturing, or plastic deformation of grains, from solution at points of grain contact, or from combinations of these factors. Precipitation of cements reduces pore space, but, because it hinders solution and compaction, it may not reduce thickness. Calculations, made for experiments involving different amounts of ductile and nonductile spheres and other shapes in orthorhombic packing, relate ductile grain content and plastic deformation to reductions in pore space and thickness, but assume that compaction and plastic deformation are carried to completion. Thus, for naturally occurring sandstones, amounts of pore space or thickness reduction that are in excess of calculated amounts could be attributed to grain rotation, grain fracturing, solution at points of contact, and/or cementation. — BHK

Rittenhouse, Suzanne. *See* McKee, Edwin D. 00200

07140 **Roberts, George D.** Soil formation and engineering applications: Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 87-105, illus., 1970.

Engineering characteristics and time-tested methods of subsurface investigation are outlined for residual soils formed from shale, carbonate, and granitic rocks; most other residual soils will fall within this range of engineering characteristics. Understanding of processes by which soils are formed and rocks weakened by decomposition assists in answering some fundamental questions regarding subsurface investigations and design of civil engineering projects; it is then possible to quite accurately predict subsurface conditions for site selection, design of subsurface investigation, interpretation of fragmentary information, preparation of proper design, and an equitable construction contract. Foundation investigations designed to disclose specific information will yield more information at less cost. — *from* Author's abstract

07457 **Robinson, Leon H.; Holland, Warren E.** Some interpretation of pore fluid effects in rock failure, Chap. 29 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 585-597, illus., table, 1970.

Pore pressure must be included in any discussion of the state of stress within a rock. In this chapter, a mathematical expression has been developed to relate boundary porosity to pore and confining pressure. Data developed earlier by Nadai (1950) are used to calculate the boundary porosity for the Pictured Cliffs sandstone and Indiana limestone. The boundary porosity found for the sandstone is 100 percent, and that for the limestone can be less than 100 percent and is related to the differential pressure. A vanishing pore pressure at rock failure could cause a drilling rate decrease in low-permeability formations. — VSN

07381 **Rochester, Eugene Wallace, Jr.** Potable water availability on long ocean islands [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1909B, 1970.

07401 **Rockaway, John D.** Engineering geology of St. Louis County, Missouri [abs.]: Mining Eng., v. 22, no. 9, p. 49, 1970.

07182 **Roddick, J. A.** Douglas Channel-Hecate Strait map-area, British Columbia: Canada Geol. Survey Paper 70-41, 56 p., illus., table, geol. map, 1970.

About 85 percent of the map-area is underlain by granitoid rocks, and most of the remainder by metasedimentary and metavolcanic rocks. At least one third of the granitoid rocks are gneissic, migmatitic complexes. Comparatively homogeneous plutonic rock ranges from gabbro to quartz monzonite. A broad belt of granitoid gneiss forms the oldest known unit (probably pre-Permian). It is overlain by a central belt of metasedimentary strata which may include Permian rocks. The dominant northwest-trending structures are deflected in a left-hand sense by the Hawkesbury Warp, one of the major flexures in the Coast Mountains. The western part of the area is cut by several northwest-trending faults of probable right-hand displacement. — Author's abstract

07266 **Rohani-Najafabadi, Behzad.** A nonlinear elastic-viscoplastic constitutive relationship for earth materials [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2669B, 1970.

00251 **Romey, William D.** Field guide to plutonic and metamorphic rocks — Earth Sci. Curriculum Proj. Pamph. Ser. PS-5: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 43 p., illus., tables, 1971.

Plutonic rocks, formed at depth, are usually coarse-grained, and contain the same minerals as lava flows; granites are the most abundant. In metamorphic rocks, minerals are commonly aligned in layers, and a greater variety of minerals is found. Conditions in the Earth's interior promoting metamorphism are described, and ways to interpret the history are suggested. Nine goals to have in mind when planning a field trip are listed. Techniques of examining outcrops are of these rocks given. More advanced studies would include describing a section, the grade of metamorphism, special features of plutons, mapping, and cross-country geology. Appendices include a key to rock-forming minerals, identification of metamorphic and plutonic rocks, percentage composition of rocks, typical mineral assemblages and probable parent rocks, and making measurements on tilted rocks. — ESL

07484 **Rooney, Lawrence F.; Ault, Curtis H.** Potential limestone and dolomite resources of northern Indiana, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 179-224, illus., tables, 1970.

The southern five-sixths of Indiana has about 90 stone quarries, the northern sixth none, requiring the latter to import limestone and dolomite from other states also. These two resources in northern Indiana are generally buried under thick glacial drift or thick drift and shale; some areas of thin drift are known and discovery of thick beds of anhydrite and gypsum in LaPorte and Marshall Counties permits consideration of limestone as a potential coproduct from a gypsum mine. The urban character and lack of quarries in northwestern Indiana are such that it may be economic to mine limestone. A study of cores from about 80-140 feet of limestone overlying the evaporite unit in the two counties indicates the rock would make class A aggregate, agricultural limestone, and a portland cement raw material. One bed 16 feet thick and 99 percent $CaCO_3$ where sampled could be used to make ground limestone. — *from* Authors' abstract

07630 **Rooney, Lawrence F.** Dimension limestone resources of Indiana: Indiana Geol. Survey Bull. 42-C, 29 p., illus., table, 1970.

Most dimension stone in Indiana is produced from Salem Limestone, and a significant amount from Laurel Member of Salamonie Dolomite, Louisville Limestone, and Geneva Dolomite. Some physical constant data of dimension stone from the chief

producers are tabulated. The Salem Limestone, overlain by St. Louis Limestone and underlain by Harrodsburg Limestone, both of Mississippian age, is a geometrically complex network of lenticular shell debris in varying sizes, deposited in margins of a fluctuating sea. Textural defects and solution channels filled with clay complicate quarrying, so that although the formation is in places more than 80 feet thick, less than 60 feet can be used; uninterrupted by bedding planes, it has almost as much strength with the grain as across it. Impurities and oxidation give it an attractive varying color. — GDC

07557 **Root, Samuel.** Disconformity exposed: Pennsylvania Geology, v. 1, no. 8, p. 3, 9, illus., 1970.

Vertical beds of sedimentary rocks are exposed in a road cut at Blue Mtn., Pa., where Interstate 81 passes through Swatara Gap. Dark shales and siltstones of the Ordovician Martinsburg Formation and light-colored quartzites and conglomerates of the Silurian Tuscarora Formation are in contact. This contact is not only a systemic boundary but also a disconformity, which is more difficult to recognize than an angular unconformity. Regional studies usually reveal disconformities when other beds are found between the two in other parts of the basin. Some of the largest oil pools are associated with disconformities. Nonmetallic minerals, gold and platinum, and uranium are concentrated at unconformities. — ESL

07284 **Roper, Paul James.** Geology of the Tamassee, Satolah, and Cashiers quadrangles, Oconee County, South Carolina [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2770B, 1970.

07440 **Rosenblad, J. Lyndon.** Development of equipment for testing models of jointed-rock masses, Chap. 8 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 127-146, illus., 1970.

A plane stress model apparatus has been developed in which strength and failure modes of a model rock mass are studied as a function of intact block geometry, joint orientation, joint properties, and confining pressure. This paper describes the development of equipment for use with the rock-block model, which are about 22 × 22 × 6 in. Digital, graphical, and photographic instrumentation has been developed for measuring and recording intact-strain data, joint-displacement data, and stress applied to the model. Tests on intact blocks of Indiana limestone and model material have verified the design. Early tests on jointed masses show that the loading apparatus can cope with large displacements along several joints in the model. — VSN

Ross, D. I. *See* Barrett, D. L. 00269

00201 **Ross, David A.** Sediments of the northern Middle America Trench: Geol. Soc. America Bull., v. 82, no. 2, p. 303-321, illus., tables, 1971.

The Middle America Trench is a tectonically unstable area in which sediments have accumulated rapidly. Little sediment accumulates permanently on the continental flank, except for a perched basin in the upper part. Sediments from the seaward flank have more biogenous material due to a lower rate of terrigenous deposition. Heavy minerals, coarse sands in the trench, facies similarities, displaced Foraminifera, and a textural gradation along the trench axis suggest that the sediments in the trench were deposited by turbidity currents. Carbon-14 dates indicate sedimentation rates as high as 146 cm/1000 yr in the trench bottom. Assuming constant conditions, the sediments found in the trench bottom would have taken only 4.5×10^6 yr to accumulate. Sediment thicknesses vary along the trench axis but are consistent with present ideas of plate tectonics. — *from* Author's abstract

07572 **Routson, Ronald Chester.** Illite solubility [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1010B-1011B, 1970.

Rowland, T. L. *See* Amsden, Thomas W. 00229

Ruch, R. R. *See* Shimp, Neil F. 00279

00198 **Ruddiman, William F.** Pleistocene sedimentation in the equatorial Atlantic — Stratigraphy and faunal paleoclimatology: Geol. Soc. America Bull., v. 82, no. 2, p. 283-301, illus., table, 1971.

Piston cores in an eastern Atlantic fracture zone at 8° N. and in the Sierra Leone basin document climatic variations over the last 1.8 m.y. Foraminiferal and paleomagnetic stratigraphies were used to correlate the cores. "Total fauna" analysis of foraminiferal variations in the last 200,000 years substantiates the oxygen-isotope trends over that interval. When applied to cores containing 1.8 m.y. of sedimentary history, this analysis pinpoints two climatic shifts: (1) at 1.3 m.y. B.P. short severe cold pulses began; (2) following 900,000 yr B.P. duration of cold intervals increased. The most recent of these correlates with Wisconsin glaciation. Although input of pelagic carbonate increases during cold intervals, carbonate percentages tend to decrease due to greater influxes of continental detritus. Beginning roughly 900,000 yr B.P. this terrigenous dilution depresses carbonate percentages in these cores. — *from* Author's abstract

Rueff, Ardel W. *See* Martin, James A. 07408

Rupert, R. J. *See* Leahy, E. J. 00321

Russell, E. E. *See* Davis, Darrell E. 07335

07444 **Russell, James E.; Hoskins, Earl R.** Correlation of electrical resistivity of dry rock with cumulative damage, Chap. 12 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 213-218, illus., 1970.

The experimental information collected during this study is in agreement with the hypothesis that electrical resistivity of dry rock should increase as damage accumulates due to cyclical loading. The experiment involved use of quartz-dolomite rock under uniaxial compression and was oriented toward air-dry surface rock that might occur in mine pillars. — VSN

Sakurai, Shunsuke. *See* Adachi, Toshihisa. 07449

07522 **Salotti, C. A.; Heinrich, E. William; Giardini, A. A.** Limestone as raw material for hydrocarbon fuels, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 48-55, illus., tables, 1970.

Inorganic hydrocarbons up to and including butane form directly in carbonate mineral-hydrogen reactions at temperatures as low as 350° C. Experimental evidence indicates hydrocarbons form directly from a mineral surface-hydrogen reaction rather than from a subsequent reaction between generated gases and hydrogen; reaction rate is rapid at temperatures below "in-air" calcination temperatures of the carbonate minerals. An inverse relation exists between complexity of hydrocarbon formed and temperature of the experiment; the lower the initial reaction temperature of the carbonate mineral-hydrogen pair, the more complex the hydrocarbon. Geologic applications and economic implications of the reaction are summarized. — *from* Authors' summary

Sanchez, Robert A. *See* Friedmann, Nadav. 00295

Sandhu, R. S. *See* Baker, L. E. 07506

Sando, W. J. *See* Mamet, B. L. 00304

Sandy, John. *See* Clements, T. H., Jr. 07168

Sandy, John. *See* Clements, T. H., Jr. 07170

Sangrey, D. A. *See* Northwood, R. P. 00297

00305 **Saunders, W. Bruce.** The Somoholitidae — Mississippian to Permian Ammonoidea, *with a section on* the Lower Permian Somohole fauna of Timor *by* W. M. Furnish and B. F. Glenister: Jour. Paleontology, v. 45, no. 1, p. 100-118, illus., tables, 1971.

The widely distributed goniatite family Somoholitidae and the two genera, *Somoholites* and *Neoshumardites*, assigned to it are described. Stratigraphic and geographic distribution and suggested phylogenetic relationships of the species are diagrammed. Five species of *Somoholites*, including two new species, *S. sagittarius* from the Middle Pennsylvanian of Ohio and Oklahoma, and *S. deroeveri*, Lower Permian of Timor, Indonesia, are described. Differences between *Neoshumardites gaptankensis*, Upper Pennsylvanian of Texas, Oklahoma, and Pennsylvania, and two Permian species from the Urals are discussed. — JWH

07183 **Sawatzky, P.** A miniaturized digital data acquisition system for high resolution magnetometer surveying: Canada Geol. Survey Paper 70-59, 95 p., illus., tables, 1970.

The elaborate procedure required to design a compact digital system suitable for use in relatively small aircraft is described. The system should be useful for agencies and firms who wish to carry out reconnaissance aeromagnetic surveys using digital recording techniques. — Author's abstract

07223 **Saxena, G. S.; Franklin, R. E.; Taylor, George S.** Importance of pulse-height analysis in the gamma-ray attenuation technique for measurement of soil moisture: Soil Sci., v. 110, no. 4, p. 283-286, illus., table, 1970.

It is shown that when long, narrow slits are used to collimate the gamma-ray beam, soil moisture can be measured by the gamma-ray attenuation technique without a pulse-height analyzer and without a calibration curve. — JWH

Sayles, F. L. *See* Manheim, F. T. 07151

Schleicher, John A. *See* Shimp, Neil F. 00279

07250 **Schleicher, John A.; Heck, David B.** Alternate methods for the determination of boron in silicates, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 138-142, illus., tables, 1970.

Two methods [emission spectroscopy and colorimetric] for determination of boron in silicates are described. The results of analyses of 83 samples by both methods were computed and subjected to statistical evaluation; the methods were shown to be identical, within experimental error, in precision and accuracy, and the results obtained by one method are interchangeable with results obtained by the other. — Authors' abstract

Schlue, J. W. *See* Knopoff, L. 07310

07436 **Schneider, Bernard.** Evaluation of geological factors in rock engineering, Chap. 3 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 43-56, illus., 1970.

This paper describes a few new or improved methods of studying fissuration, the fundamental characteristic affecting engineering properties of rock, and its influence on major engineering factors such as permeability, deformability, or internal stresses in rock volume. Methods of evaluation include laboratory tests on samples using thin slices, jack loading tests in the field, seismic studies on a large scale, and studies of internal stresses in adits using a geophone. — VSN

Schnepfe, M. M. *See* Grimaldi, F. S. 00262

00317 **Schoenwetter, James; Doerschlag, Larry A.** Surficial pollen records from central Arizona — [Pt.] 1, Sonoran Desert scrub: Arizona Acad. Sci. Jour., v. 6, no. 3, p. 216-221, illus., table, 1971.

Pollen analysis of 15 surface sediment samples from the *Larrea-Franseria* plant association of the desert scrub ecosystem illustrates local pollen rain variation as a response to substrate conditions. All but samples 1, 2, and 5 are from archeological sites. Samples 1-5 are from the colluvium of the lower bajadas, on which the association is typically found; 6-10 are from colluvium on Pleistocene terraces of the Salt and Gila Rivers; 11-15 are from alluvium of tributary floodplains, representing a variety of habitats. The relatively coarsest-grained substrates had the highest percentage of Compositae pollen and the finest-grained had the highest percentage of Graminae pollen, regardless of their floral patterns or nature of the site. It is apparent that the true controlling variable in this ecosystem is local habitat xericity; finer-grained substrates have a higher water-holding capacity. — VMJ

00281 **Schram, Frederick R.** A strange arthropod from the Mazon Creek of Illinois and the trans Permo-Triassic Merostomoidea (Trilobitoidea): Fieldiana — Geology, v. 20, no. 6, p. 85-102, illus., 1971.

Kottixerxes gloriosus, n.gen., n.sp., from the Middle Pennsylvanian Essex fauna of the Mazon Creek area, Illinois, is placed in Euthycarcinoidea, here emended, an order of the trilobitoid subclass Merostomoidea, as it appears to be closely related to two Mesozoic euthycarcinoids, *Euthycarcinus kessleri* Handlirsch, 1914, from the Lower Triassic of Germany, and *Synaustrus brookvalensis* Riek, 1964, from the Middle Triassic of Australia. There is a lesser possibility that the euthycarcinoids may be Merostomata; several reasons are discussed for not placing them in Crustacea. Their Middle Pennsylvanian to Middle Triassic range (long after trilobitoids were thought to be extinct) adds the Euthycarcinoidea to a growing list of groups that cross the Permo-Triassic boundary unaffected. — VMJ

07638 **Schultz, C. Bertrand; Martin, Larry D.** The machairodont cats from the early Pleistocene Broadwater and Lisco local faunas: Nebraska Univ. State Mus. Bull., v. 9, no. 2, p. 33-38, illus., tables, 1970.

A new species of *Ischyrosmilus* (*I. crusafonti*) is reported from the early Pleistocene Broadwater Local Fauna of Morrill County, Nebraska. *Ischyrosmilus* sp. is reported from the early Pleistocene Lisco Local Fauna. *Megantereon* is reported from the Broadwater Local Fauna, and this is the first record of the genus from North America. — Authors' abstract

Schwab, F. A. *See* Knopoff, L. 07310

00219 **Schwartz, Maurice L.** The multiple causality of barrier islands: Jour. Geology, v. 79, no. 1, p. 91-94, illus., 1971.

Current literature proposes three basically different explanations of formation of barrier islands: upbuilding of offshore bars, cutting of inlets through spits, and submergence of ridgelike coastal features. Multiple causality is advocated here: any of these causes, proceeding independently or in concert, can form barrier islands. A proposed classification distinguishes barrier islands as: (1) primary (engulfed beach ridges); (2) secondary (breached spits, and emergent offshore bars associated with either rise or fall of sea level; and (3) composite (combinations of two or more of the above). — DRM

Schweinfurth, Stanley P. *See* Berryhill, Henry L., Jr. 07216

07361 **Schwietering, Joseph Francis.** Devonian shales of Ohio and their eastern equivalents [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2067B, 1970.

07308 **Sclater, J. G.; Jones, E. J. W.; Miller, S. P.** The relationship of heat flow, bottom topography and basement relief in Peake and Freen deeps, northeast Atlantic, *in*

Geothermal problems — Symposium, Madrid, Spain, 1969, Proc.: Tectonophysics, v. 10, nos. 1-3 (spec. issue), p. 283-300, illus., table, 1970.

Values of nine closely spaced heat flow observations, made near 43°N 20°W during a survey of Peake and Freen deeps on the eastern side of the Mid-Atlantic Ridge, range from 1.23 to 1.76 μcal/cm^2 sec; all are close to the Atlantic average of 21.34 μcal/cm^2 sec. This result, together with the absence of any known earthquake epicenters, implies that there is no igneous activity in the area at present. Quantitative estimates of effects of variations of water temperature and recent rapid sedimentation show that it is unlikely that these effects are of sufficient magnitude to explain the observed scatter in heat flow values. A numerical method is developed to compute heat flow through a region where both irregularities in sediment thickness and topographic relief are known. It is demonstrated that the observed variation of sediment thickness and surface relief in the vicinity of the stations can explain differences in heat flow. — *from* Authors' summary

Scott, J. B. *See* Kruse, G. H. 07442

00247 **Scott, J. S.** Regional geology and landslides in the marine clay deposits of eastern Canada — Discussion [of paper by P. LaRochelle, et. al., 1970]: Canadian Geotech. Jour., v. 8, no. 1, p. 138-142, illus., 1971.

The original paper was published ibid., v. 7, no. 2, p. 145-156, 1970; *see* Abstracts of North American Geology, January 1971. — ESL

07142 **Scott, Ralph G.** Vladim Voloshin (1934-1970): Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 123-125, portrait, 1970.

00310 **Scott, Robert B.** Alkali exchange during devitrification and hydration of glasses in ignimbrite cooling units: Jour. Geology, v. 79, no. 1, p. 100-110, illus., 1971.

Alkali-ion exchange between rock and aqueous phases during devitrification and secondary hydration of ignimbrite sheets contributes significantly to observed chemical variations in densely welded glassy and devitrified tuffs. Probably most of the alkali-ion exchange occurs during the cooling period because ion exchange affects interiors of slowly cooling thick (> 300 foot) units, whereas rapidly cooling thin (< 100 foot) units show no evidence of alkali exchange in their interiors. Leaching by groundwater removes alkalis from partially or nonwelded margins of cooling units. Distinct stratigraphic breaks in trends of alkalis indicate that individual eruptive pulses of ash-flow material, now welded into one cooling unit, had distinctive alkali ratios related to magmatic inhomogeneities. — Author's abstract

Scott, V. H. *See* Guymon, G. L. 07468

07528 **Segall, R. Thomas.** Slag — Michigan's all-purpose construction aggregate, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 117-126, illus., tables, 1970.

Iron ores, fluxstones, and coke are combined into Detroit's steel making furnaces to form pig iron, steel, and slag. Detroit's slag, a nonmetallic material consisting mainly of silicates and alumnosilicates of lime, was once discarded as a waste material, but since 1921, this slag has been processed economically by the Edward C. Levy Company of Detroit. New uses and continual growing markets for slag combined with the higher transportation costs for sand and gravel into the Detroit area have lead to one of Michigan's most important construction stone industries. — Author's abstract

Serata, Shosei. *See* Adachi, Toshihisa. 07449

07383 **Sevian, Walter Andrew.** Nonlinear dispersion of groundwater disturbances [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1948B-1949B, 1970.

07480 **Sevon, William D.** Palmerton Sandstone as a source of sand in Carbon and northeastern Schuylkill Counties, Pennsylvania, *in* Forum on geology of industrial

minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 119-137, illus., table, 1970.

Nearly 0.5 million tons of general use and refractory sand are produced yearly from the Middle Devonian Palmerton Sandstone between Little Gap and Andreas; the quartz sandstone has been complexly folded into a series of overturned anticlines and synclines and is variably cemented with silica. The unit has a well-developed joint system which dominates the outcrop appearance of the sandstone and aids in rock disintegration. Silica usually constitutes over 98 percent of the sandstone, but hematite and clay are contaminants which locally affect sand quality. Hematite and silica cementation markedly affect sandstone quarry-ability, while structure is critical in quarry locations. Ideal quarry sites occur in plunging antiform structures, while plunging synform structures and linear ridges are successively less desirable sites. — *from* Author's abstract

07536 **Shafer, G. H.** Ground-water resources of Aransas County, Texas: Texas Water Devel. Board Rept. 124, 81 p., illus., tables, geol. map, 1970.

In Aransas County in the Coastal Bend region of south Texas, aquifers that yield water to wells are the Gulf Coast aquifer, chiefly of Pliocene and Pleistocene age and underlying the entire county, the Pleistocene barrier islands and beach deposits of the peninsulas, and the Holocene barrier island deposits of St. Joseph Island. Almost all ground water for public and industrial use is obtained from the Gulf Coast aquifer, with transmissibility about 3,000 gpd per ft. About 600,000 acre-feet of fresh and slightly saline water underlies Live Oak Peninsula, of which about 300,000 acre-feet is recoverable, although subject to contamination by salt water. In much of the rest of the county slightly saline water predominates. The threat of salt-water intrusion from sands under the fresh-water zone limits development of water supplies. — *from* Author's abstract

07131 **Shapiro, Leonard.** Rapid rock analysis today, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 143-157, illus., table, 1970.

Three main routes are undergoing rapid development for rapid analysis of rocks. Spectrographic emission procedures have been adapted to major constituents and are being automated and computerized so that a broad range of constituents can be determined simultaneously. X-ray fluorescence is being improved via developments in detectors and X-ray sources, and chemical methods have proliferated. In the U.S. Geological Survey's rapid-analysis project, particularly in the chemical approach, methods which are simple and rapid have been developed and applied to thousands of diverse silicate rocks. Atomic absorption techniques, as commercial instrumentation became available, greatly simplified determinations of constituents for which good spectrophotometric procedures are not available. Some automation and mechanization have contributed accuracy and convenience. — *from* Author's abstract

07125 **Sharp, D. A.** Ontario's petroleum resources — How significant are they,, Tech. Paper 2 *in* Ontario Petroleum Inst., 9th Ann. Conf., Ottawa, 1970: Chatham, Ontario, Ontario Petroleum Inst., 12 p., paged separately, illus., 1970.

The Canadian petroleum industry had its beginning over 100 years ago at Oil Springs, Lambton County, Ontario. Although Ontario's petroleum resources are presently a minor contributor to the province's energy requirements, these resources have played an important role in the supply of natural gas which is now widely used. With at least three new reef discoveries in Lambton County, several new pools in Lake Erie, and increased activity in the Hudson's Bay and James Bay Lowlands, the future of the Ontario industry appears promising; production should increase and play a significant role in the overall supply of petroleum resources in Ontario and eastern Canada. — *from* Author's abstract

07650 **Shaver, Robert H.** (and others). Compendium of rock-unit stratigraphy in Indiana: Indiana Geol. Survey Bull. 43, 229 p., illus., tables, 1970.

The Geologic Names Committee of the Indiana Geological Survey for several years has maintained tables of the more important rock- and time-stratigraphic names used in the State. The main body of this report, Rock-Unit Names, is arranged alphabetically and consists of historical, bibliographic, descriptive, and correlative information for each rock-unit name. Names regarded by the Indiana Geological Survey as unofficial are not given primary treatment, but pages where their status is reviewed can be located through the index. Locations of type sections and type localities are shown on a map accompanying the report, along with tables listing rock-unit names for the Tertiary-Quaternary, Pennsylvanian, Mississippian, Silurian-Devonian, and Cambrian-Ordovician. — ESL

00234 **Shaw, Alan B.** The butterfingered handmaiden: Jour. Paleontology, v. 45, no. 1, p. 1-5, tables, 1971.

Analysis of the published records of 8,337 fossil taxa in 15 annual volumes of the *Journal of Paleontology*, *Micropaleontology*, and *Palaeontology* reveals that 5,024 (60.3 percent) of them lacked a statement of the measured stratigraphic position at which the fossils were found. A total of 693 authors' names appeared on the 618 articles reviewed; taking the output of only the top two authors from each annual volume reviewed it was found that these 30 authors (4.3 percent of the total) had produced 1,795 (54.2 percent) of the fully documented taxa, indicating that only a small minority of publishing paleontologists are sufficiently convinced of the importance of precise stratigraphic documentation to include it in their work. — Author's abstract

07647 **Shaw, David Montgomery.** Thermodynamic studies of paleoclimates [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1353B, 1970.

07312 **Shaw, Nolan G.** (editor). Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, 335 p., illus., tables, 1970.

This volume includes a dedication to Dr. C. O. Durham of Louisiana State University; lists the officers and executive committee of the Gulf Coast Association of Geological Societies and officers of the member societies; reports of the president of the GCAGS, general chairman of the 20th annual meeting, and editor; organization of the 20th annual meeting; a list of officers and business representatives of the Gulf Coast Section of the Society of Economic Paleontologists and Mineralogists; reports of the president and editor of that section; names of and data on recipients of the Best Paper Awards at the 19th annual meeting; a price list of publications of the GCAGS; various acknowledgments; and texts or abstracts of the technical papers presented at the 20th annual meeting (held in Shreveport, Louisiana, on October 28-30, 1970). The 25 papers are cited separately. — DBV

07126 **Shaw, William.** Petroleum potential in the Maritime region of Canada, Tech. Paper 3 *in* Ontario Petroleum Inst., 9th Ann. Conf., Ottawa, 1970: Chatham, Ontario, Ontario Petroleum Inst., 13 p., paged separately, 1970.

The search for commercial quantities of petroleum and natural gas in the Maritime region has continued since 1859. Rocks of the mainland are crystalline in the highlands, and unmetamorphosed sedimentary occupying the lowlands and underlying most of the Gulf of St. Lawrence, Bay of Fundy, and offshore; onshore exploratory efforts have taken place within the sedimentary environment. The mainland region lies within the Appalachian belt and forms the northeastern end of this system. Sediments range in age from Mississippian through Pennsylvanian and into Permian, with some Triassic parallel to the southeast shore of the Bay of Fundy. Five types of structures are the focus for exploration in northern Nova Scotia and the Sydney area. Offshore drilling results indicate reserves of 24.7 billion bbl oil and 150 trillion cubic feet of gas. — MCM

07127 **Shea, Frank S.** Industrial mineral potential of the Maritime Province region of Canada, Tech. Paper 4 *in* Ontario Petroleum Inst., 9th Ann. Conf., Ottawa, 1970: Chatham, Ontario, Ontario Petroleum Inst., 7 p., paged separately, 1970.

Many areas of the Atlantic region have not been assessed economically for industrial minerals, particularly the continental shelf that has a potential for petroleum and

natural gas. Basically most industrial minerals are produced from Carboniferous rocks which ocupy large areas in each province. Structure and stratigraphy are somewhat difficult to determine and establish due to sparseness of outcrops in many areas, general lack of lithology, distinct and laterally continuous formations easily recognizable and easily traced, and scarcity of diagnostic fossils needed for dating and correlation. Various operations in the industrial mineral field are summarized by province. Petroleum and natural gas interests in onshore exploration will direct attention to areas underlain by Carboniferous systems where most industrial minerals are found. — MCM

07554 **Shideler, Gerald L.** Petrography of the Johns Valley boulders, Ouachita Mountains: Oklahoma Geology Notes, v. 30, no. 5, p. 98-117, illus., 1970.

The boulder assemblage of this Late Mississippian-Early Pennsylvanian formation [SE Oklahoma-SW Arkansas] is extremely heterogeneous, being composed of clasts belonging to 9 major petrographic groups that encompass 19 petrographic classes. Carbonate clasts are highly dominant, constituting 75 percent of the boulder assemblage. Most carbonate boulders are dolomitic limestones, which consist of several petrographic varieties. Siliceous rocks constitute 18 percent of the boulders, most of which are weathered chert nodules. Clastic specimens are least abundant, constituting only 7 percent of the boulders, most of which are arenites. On the basis of petrographic and megascopic properties, the boulders appear to have been derived from stratigraphic units indigenous to the Arbuckle and Ozark facies of the foreland province, as well as from units of the frontal and central Ouachita Mountain provinces. — Author's abstract

Shieh, W. Y. *See* Baker, L. E. 07506

00279 **Shimp, Neil F.; Schleicher, John A.; Ruch, R. R.; Heck, David B.; Leland, Harry V.** Studies of Lake Michigan bottom sediments — No. 6, Trace element and organic carbon accumulation in the most recent sediments of southern Lake Michigan: Illinois Geol. Survey Environmental Geology Note 41, 25 p., illus., tables, 1971.

Trace elements were determined in 21 grab samples and sections of 21 cores from southern Lake Michigan; in all, 119 sediment samples were analyzed for 13 trace elements, organic carbon, and less than 2-micron clay. Results show that bromine, chromium, copper, lead, and zinc are accumulating in the uppermost, recently deposited sediments (0 to 10 cm) of deeper regions of southern Lake Michigan. Prominent areas of concentration occur in sediments off Grand Haven and Benton Harbor, Mich.; off Waukegan, Ill.; and in the lake center near the Illinois-Wisconsin border. Concentrations of these five trace elements generally increase as the amount of organic carbon increases. Trace elements showing little or no accumulation are beryllium, boron, cobalt, lanthanum, manganese, nickel, scandium, and vanadium. — *from* Authors' abstract

07132 **Shimp, Neil F.** Silicate analysis as viewed by geological surveys, *in* Developments in applied spectroscopy, V. 8 — Mid-America Spectroscopy Symposium, 20th Ann., Chicago, Ill., 1969, Selected papers: New York and London, Plenum Press, p. 158-167, illus., tables, 1970.

Nowhere is silicate analysis more commonly encountered than in the laboratories of geological surveys. Whether instrumental or wet, it is one of the most difficult and exacting forms of analysis, often requiring many hours for one determination. As analysts in such laboratories are confronted with a bewildering variety of samples, they must be familiar with many chemical and physical methods of analysis. A particular philosophy and special types of training are required of a successful analyst in this field. A geological working environment poses special problems for silicate analysts. The reasons for making so many silicate analyses and the scope and degree of difficulty of such analyses are explained, and analytical applications and unusual silicate work at the Illinois State Geological Survey are discussed and illustrated. — Author's abstract

07477 **Siebert, Harry L.** Connecticut's declining sand and gravel resources, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 43-54, illus., table, 1970.

Historically, adequate volumes of sand and gravel resources existed in Connecticut, the better sources being stream and river valleys. Factors other than accelerated construction have reduced their availability: restrictive zoning, reserving land for recreation, water supply, and highway alinements constructed along lineal drainage basins. Urbanization has rapidly reduced sand and gravel availability as these areas are favored sites for industrial, commercial, and residential development. A new and not yet evaluated restrictive factor is the new clean water standards which do not allow the direct introduction of fines from washing into streams and rivers. Substitution of "traprock" for the coarse aggregate fraction to produce processed gravel with sand has become feasible. — *from* Author's abstract

07405 **Siegel, Harold O.** The diversity of I.P. responses of lead-zinc deposits in carbonate rocks [abs.]: Mining Eng., v. 22, no. 9, p. 52, 1970.

Silberling, Norman J. *See* Keen, Myra A. 00264

00196 **Sill, W. R.** Electrical conductivity and temperature of the lunar interior: Jour. Geophys. Research, v. 76, no. 1, p. 251-256, illus., 1971.

Lunar models with conductivity of the order of 10^{-2} mho per m below 300 km are compatible with Apollo 12 magnetometer data, assuming that the toroidal response is negligible. Assuming olivine or pyroxenite as representative of the composition of the lunar interior, this conductivity corresponds to temperatures of about 1200°-1400°K. When the maximum possible effect of a toroidal response is taken into account, the results are compatible with a conductivity of 2×10^{-4} mho per m below 100 km, which is equivalent to olivine and pyroxenite conductivities at 850°K and 1050°K, respectively. Lower frequency calculations can unambiguously determine the contribution from the toroidal mode and improve models for the conductivity and temperature of the lunar interior. — DBV

Simmons, O. K. *See* Duguid, D. R. 00299

Simmons, Weldon A. *See* Kesler, Stephen E. 00301

07247 **Simpson, George Gaylord.** Uniformitarianism — An inquiry into principle, theory, and method in geohistory and biohistory, [Chap.] 2 *in* Essays in evolution and genetics in honor of Theodosius Dobzhansky — A supplement to evolutionary biology (Max K. Hecht and William C. Steere, editors): New York, Appleton-Century-Crofts, p. 43-96, 1970.

In this comprehensive review essay, the doctrine or school of uniformitarianism, as applied to geology and biology as historical sciences, is traced from its origin with Hutton and Lyell. Lyell's steady-state model of earth and life history is contrasted with Conybeare's directional model. Lyell's uniformitarianism strongly influenced Darwin's geological concepts; conversely, Darwin's evolutionism influenced Lyell away from a steady-state interpretation of organic history. The many uniformitarian principles are classified into those concerned mostly with: immanent properties (naturalism, actualism); configurations (historicism, evolutionism, gradualism vs. catastrophism); special methodology (historical inference, retrodiction, extrapolation); and the present status of each is considered. Retrodictive interpretation of geohistory and biohistory requires application of uniformitarian principles such as actualism and gradualism. — VMJ

07245 **Sims, P. K.; Westfall, I.** (editors). Summary of fieldwork, 1970: Minnesota Geol. Survey Inf. Circ. 8, 24 p., illus., 1970.

This summary contains 35 short reports on field work in Minnesota.

Siple, George E. *See* Bloxham, W. M. 07608

Skelton, John. *See* Harvey, Edward J. 07410

07128 **Skidmore, Brian.** Petroleum potential in the Gaspé region of Quebec, Tech. Paper 5 *in* Ontario Petroleum Inst., 9th Ann. Conf., Ottawa, 1970: Chatham, Ontario, Ontario Petroleum Inst., 21 p., paged separately, illus., 1970.

Within the folded belt of the Gaspé-Temiscouata region, rocks have been thrust northwestward onto Ordovician rocks; Cambrian to Middle Ordovician sediments and volcanics are overlain by gently folded, unmetamorphosed Silurian and Devonian strata. A narrow belt trending southwesterly from southeastern Gaspé Peninsula received continuous marine sedimentation in Late Ordovician; in Silurian and earliest Devonian the most rapid deposition followed roughly the same trend. In early Devonian marine regressive sandstone graded into continental deposits. Petroleum exploration has been directed toward: lower part of Devonian sandstone sequence in east central Gaspé (tested by drilling); reefoid limestone in Silurian rocks bordering the central trough; and shelf or miogeosynclinal sediments of the St. Lawrence Lowlands province that may underlie the thrust zone. — *from* Author's abstract

07627 **Skidmore, E. L.; Fisher, P. S.; Woodruff, N. P.** Wind erosion equation — Computer solution and application: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 931-935, illus., table, 1970.

A wind-erosion equation was programmed for computer solution. The relationships among variables are evaluated by the computer, and the general functional relationship between soil loss and various independent variables is solved stepwise to give potential average annual soil loss in tone per acre annum for specific conditions of erodibility, roughness, climatic factor, equivalent field length, and equivalent vegetative cover. The computer also can solve the equation to determine field conditions necessary to reduce potential erosion to a tolerable amount and can compare the effectiveness of various combinations of erosion control treatments. — *from* Authors' abstract

Skipp, Betty. *See* Mamet, B. L. 00304

Slebir, Edward J. *See* Wallace, George B. 07455

07240 **Smith, Bruce D.; Hodge, Dennis S.; Smithson, Scott B.** Geology and geophysics of syenites associated with Laramie anorthosite, Wyoming: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 27-38, illus., table, 1970.

Pyroxene and hornblende syenites comprise the northern border of the Laramie anorthosite complex. The syenites intrude regional gneisses that are metamorphosed in the middle to upper amphibolite facies. Locally the syenites have caused thermal metamorphism in country rocks. Chemical and mineralogical composition of these syenites closely resembles composition of syenites from other anorthosite complexes. Syenite has been partially emplaced by forcible intrusion. Positive gravity anomalies follow the syenites and peak over norite exposed within hypersthene syenite; however, densities of syenites are lower than densities of most other rocks in the area. Gravity interpretation suggests that syenites are underlain at shallow depth by dense rocks such as norite. The mass of the dense rocks is several times greater than the mass of the syenite. This interpretation indicates that syenites were formed by differentiation from mafic rock associated with anorthosite. — Authors' abstract

07481 **Smith, George I.** Geologic frontiers in exploration for sedimentary industrial minerals, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 141-152, 1970.

As expanding urban areas encroach upon known industrial mineral deposits and new sources must be found, geologic principles provide fundamental guides in the search. Many deposits are clastic or chemical sediments and efficient prospecting requires up-to-date knowledge of processes that control their depositional patterns. Paleoclimatology provides insight into migrating patterns of past climates and their influence on location of chemical and organic sediments, i.e., bauxite, barite, diagenetic clay

and bentonite, and etc. Progress has been made in understanding processes that control chemical sedimentation and diagenesis that alters sediments shortly after burial. Laboratory innovations in the study of slow crystallization processes and increasing use of thermodynamic extrapolation provide more knowledge of the probable diagenetic mineral assemblages and the place where they should be found in a given geologic setting. — *from* Author's abstract

Smithson, Scott B. *See* Smith, Bruce D. 07240

07395 **Snyder, Frank G.** Structural lineaments and mineral deposits, eastern United States [abs.]: Mining Eng., v. 22, no. 8, p. 36, 1970.

07487 **Socolow, Arthur A.; Allen, George E.; Coxey, James R.; Dunn, James R.; Masland, Frank A., Jr.; Minnick, L. John.** Symposium on industrial minerals, land use and conservation problems (a panel discussion), *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 259-271, 1970.

Members of the panel represented the fields of geology, land use planning, conservation, industry, and state government in the topics under discussion. — MCM

07435 **Somerton, Wilbur H.** (editor). Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, 762 p., illus., tables, 1970.

This symposium is the second sponsored by the Intersociety Committee on Rock Mechanics. The three-day program was divided into six sections — geologic factors, simulation of geologic factors, simulation of rock behavior, field studies, role of fluids, and recent developments — and included 34 papers. Twenty-nine papers are cited separately. — VSN

07659 **Sonderegger, John L.** Hydrology of limestone terraces — Photogeologic investigations: Alabama Geol. Survey Bull. 94, pt. C, 26 p., illus., geol. maps, 1970.

Panchromatic, color, and infrared films were used to locate fracture traces as an aid to the interpretation of the occurrence and movement of ground water in a limestone area. Air photography using color and infrared films resulted in greater interpreter confidence and showed correlation with geologic structure. Wells drilled along fracture traces yielded substantially more water than the average of the randomly located wells. The thickness of the residuum had no noticeable control over the fracture-trace concentration. Previous models explaining the relationship between fracture traces and solution activity dealt with a single homogeneous limestone aquifer. In this area, two limestone aquifers separated by an aquiclude produce two different lithologic units on which solution features that are reflected by fracture traces are developed. — Author's abstract

07660 **Sonderegger, John L.; Kelley, James C.** Hydrology of limestone terraces — Geologic investigations: Alabama Geol. Survey Bull. 94, pt. B, 146 p., illus., tables, geol. maps, 1970.

The project area includes the Athens and Elkmont 7-1/2-minute quadrangles, an area of about 117 sq mi in north-central Limestone County near the center of northern Alabama. It occupies the Nashville Basin and Highland Rim sections of the Interior Low-Plateaus province and is drained by the Elk and Tennessee Rivers. Sedimentary rocks of Paleozoic age are overlain by residuum up to 100 feet thick. Quaternary alluvium forms sizeable deposits along the major creeks. Solution activity is the major factor causing "deformation" structures in the northern Highland Rim area. Tectonic structure has been modified by ground-water solution. Stratigraphic and structural factors are related to the ground-water hydrology. Measured geologic sections and well cutting descriptions are provided. — *from* Authors' abstract

00238 **Sorauf, J. E.** Microstructure in the exoskeleton of some Rugosa (Coelenterata): Jour. Paleontology, v. 45, no. 1, p. 23-32, illus., 1971.

Study of *Thamnophyllum*, *Pachyphyllum*, *Tabulophyllum*, and *Charactophyllu*, Upper Devonian, Iowa, by scanning electron and petrographic microscopy indicates that these rugosans have much in common with modern Scleractinia in terms of formation and structure of their exoskeleton. It is possible that all rugosan septa are trabecular in construction, because lamellar structures are apparently secondary, and at least some fibro-normal structures are in part the result of modification of trabecular septa by diagenetic processes. The question of original skeletal mineralogy remains unanswered, with some evidence that it was calcitic. However, recent study of aragonite inversion or recrystallization to calcite in scleractinians shows that structures produced by these processes are close to those noted in the few rugose corals studied to date. — *from* Author's abstract

07610 **Sorensen, Harry O.** Michigan's clay deposits and industry, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 143-155, illus., tables, 1970.

Clay and shale suitable for production of clay products and cement are found in much of Michigan. Glacial clays are used in the manufacture of brick, tile, cement, pottery, and lightweight aggregate while undeveloped deposits could be used for pottery purposes; some may be suitable for special purposes as the clays are more carefully tested. Shales of the Traverse Group and Antrim and Ellsworth Formations (Devonian) are used in manufacture of portland cement, shale of the Pennsylvanian Saginaw Formation for tile. Other potential shale beds in Ordovician, Silurian, Devonian, and Mississippian formations have potential in the manufacture of brick, cement, and lightweight aggregate. — *from* Author's abstract

00222 **Spall, Henry.** Paleomagnetic evidence for a Cretaceous disturbing event in the Precambrian Johnny Lyon Granodiorite, Cochise County, Arizona: Jour. Geology, v. 79, no. 1, p. 118-122, 1971.

Block samples were collected in an E-W profile across the 1,655 m.y.-old Johnny Lyon Granodiorite in Cochise County, Ariz. Progressive alternating field demagnetization shows that the NMR directions are stable to 175 Oe, and remain tightly grouped. Beyond this field the angular changes are large and irregular. The mean directions initially and after 175 Oe are remote from either the axial or the inclined present fields. The corresponding paleomagnetic pole after 175 Oe shows good agreement with North America Cretaceous poles and supports the conclusion from isotopic studies (Silver and Deutsch, 1963) that the granodiorite was profoundly affected by a Cretaceous alteration process. — *from* Author's abstract

07242 **Speden, Ian G.** The type Fox Hills Formation, Cretaceous (Maestrichtian), South Dakota — Pt. 2, Systematics of the Bivalvia [with German and Russian abs.]: Yale Univ. Peabody Mus. Nat. History Bull. 33, 222 p., illus., tables, 1970.

Meek's classical studies (1856-1876) on faunas of the type Fox Hills Formation, north-central South Dakota, provided an important basis for zonation and correlation of the latest Cretaceous. Pelecypods, which dominate the fauna specifically and numerically, are here taxonomically revised; concepts of population systematics are used as a basis for paleoecological studies. About 100,000 specimens from 264 localities were examined, in addition to type and older collections; 49 genera (in 24 superfamilies) are recognized, 2 new (*Nymphalucina* and *Sourimis*, with type species from *Tellina*), and *Pseudoptera*, *Clisocolus*, *Tellinimera*, *Opertochasma* are emended; 58 species, 7 new, are described in detail, with simple statistical parameters. This study suggests that many of the species described from the Upper Cretaceous of western interior U.S. may require revision. — VMJ

07285 **Squyres, John Benjamin.** Origin and depositional environment of uranium deposits of the Grants region, New Mexico [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2770B, 1970.

07385 **Srinivasan, Vajapeyam S.** The mechanics of flat bed flow and occurrence of bed forms in alluvial channels [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1989B-1990B, 1970.

Stanley, Daniel J. *See* Fenner, Peter. 00258

00224 **Stanley, K. O.; Jordan, W. M.; Dott, R. H., Jr.** New hypothesis of Early Jurassic paleogeography and sediment dispersal for western United States: Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 10-19, illus., table, 1971.

Recent studies of composition and sedimentary structures of Upper Triassic and Lower Jurassic clastic rocks in the Cordillera provide evidence for a modified paleogeographic reconstruction. The presence of marine Triassic rocks in north-central Nevada and of mature quartz sandstones in western Nevada and southeastern California indicates that no continuous Mesocordilleran geanticline completely separated the miogeosynclinal and eugeosynclinal belts during early Mesozoic time. In southern Nevada, Upper Triassic and Lower Jurassic sedimentary strata considered typical of miogeosynclines are interstratified with conglomerates and volcaniclastic rocks derived from a rising volcanic island arc in the west in California. The source of the Navajo sandstone is older sandstones in Montana and Alberta. A broad marine carbonate bank is present in Nevada. — *from* Authors' abstract

Stateham, Raymond M. *See* Merrill, Robert H. 07394

07654 **Statler, Anthony T.; Sykes, C. Ronald.** Geologic map (and coal maps) of the Duncan Flats quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 129-NE, 7 sheets, scale 1:24,000, separate text, 1970.

The six coal maps cover the following coal seams: Big Mary, Cold Gap, Jellico, Petros, Coal Creek, Poplar Creek, Grassy Spring, Joyner, Blue Gem, Lower Wildcat, Rock Spring, Petree, Walnut Mtn., Red Ash, Sharp, Beech Grove, Upper Pioneer, Jordan, Pewee, and Windrock. The only mined mineral resources in the Duncan Flats quadrangle is coal; there are 338 known mines or prospects in 18 seams, of which 11 have been mined. Potential resources are sandstone and shale. — MCM

Stauder, William. *See* Guha, Shyamal K. 07534

07590 **Stearns, David W.** Drape folds over uplifted basement blocks with emphasis on the Wyoming province [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1253B, 1970.

07210 **Stebbins, G. Ledyard.** Variation and evolution in plants — Progress during the past twenty years, [Chap.] 6 *in* Essays in evolution and genetics in honor of Theodosius Dobzhansky — A supplement to evolutionary biology (Max K. Hecht and William C. Steere, editors): New York, Appleton-Century-Crofts, p. 173-208, 1970.

This review paper primarily treats studies on living higher plants, especially angiosperms, but also includes paleobotanical material on early evolution of angiosperms, geographic distribution patterns of Cenozoic floras, and palynology as applied to plant evolution. — VMJ

Stefanko, R. *See* Su, Y. L. 07446

Stefanko, R. *See* Hardy, H. R., Jr. 07451

00210 **Steineck, P. Lewis; Gibson, James M.** Age and correlation of the Eocene Ulatisian and Narizian stages, California: Geol. Soc. America Bull., v. 82, no. 2, p. 477-480, illus., 1971.

In western California gross correlation based upon planktonic foraminifers reveal an age disparity between strata containing the same benthic foraminiferal indices of the Mallory zonation. Strata containing benthic assemblages that characterize the Ulatisian range in age from late early Eocene (upper Lodo) to early middle Eocene (Rose Canyon), whereas Narizian sequences are early middle Eocene (Cozy Dell-Matilija) or late middle Eocene (Poway, Sacate) in age. Significantly none of the Narizian sequences for which planktonic or nannoplankton data are available are late Eocene in age. Instead, upper Eocene strata in California are represented in the superjacent Refugian stage, considered to be Oligocene by Mallory and by Lipps. — EHP

07393 **Stephens, J. D.; Wittkopp, R. W.** The many-fingered microprobe: Mining Eng., v. 22, no. 7, p. 120-122, illus., 1970.

The electron-beam microprobe can be used in mineral exploration to determine the mode of occurrence of elements or minerals; the mode of occurrence may determine whether a given deposit is economically exploitable. The microprobe also has practical applications in mining, milling, smelting, and refining operations. Practical examples of each type of application are given. — MAC

Stewart, J. H. *See* Davis, W. E. 07500

07478 **Stewart, Nanna Bolling.** Detailed petrography, an aid in the evaluation of gravel aggregates for freeze-thaw resistance, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 55-89, illus., tables, 1970.

Seven gravels (glacial, glaciofluvial, fluvial) from sites in northern and central Pennsylvania were studied petrographically to determine their response to conditions of freezing and thawing, as aggregate in concrete. Sample aquisition and preparation, petrographic fractionation methods, and cylinder analysis are described; tabulated data were analyzed by lithologic and specific gravity correlation. Results indicate that the medium and coarse-grained quartzites (when uncontaminated by fine grained quartzites or other rocks) and limestones are freeze-thaw resistant. Sandstones are tentatively rated as fair, not enough is known about high rank graywackes to extend an opinion, and fine-grained low rank graywackes and fine-grained quartzites are very deleterious. With the exception of grain size, rock characteristics are uninfluential on freeze-thaw soundness. Recommendations are made for further research. — MCM

Stieglitz, Ronald D. *See* Hay, William W. 07463

07286 **Stirewalt, Gerry Lewis.** Structural analysis of the Sauratown Mountains anticlinorium and the Brevard lithologic zone, North Carolina [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2770B-2771B, 1970.

07525 **Stith, David A.** Potential use of Ohio limestones and dolomites for architectural aggregate, *in* Forum on Geology of Industrial Minerals, 6th, Ann Arbor, Mich., 1970, Proc.: Michigan Geol. Survey Miscellany 1, p. 81-86, tables, 1970.

The expanding use of exposed-aggregate concrete in architectural surfaces has caused an increase in requests for suitable stone. A literature survey was initiated to determine the requirements for architectural aggregate. A set of 18 carbonate rock samples was collected from various quarries in Ohio, providing a wide geographic and stratigraphic coverage of the State. The samples were subjected to physical tests for absorption, soundness, and hardness, as were two silica samples collected for comparison. Good results were obtained in two cases, a Guelph Dolomite sample and a Niagaran sample (Huntington, restricted). Fair results were obtained in four other cases, two Cedarville Dolomite samples, a Columbus Formation sample, and a Niagaran sample. — Author's abstract

00213 **Stoiber, Richard E.; Carr, Michael J.** Lithospheric plates, Benioff zones, and volcanoes: Geol. Soc. America Bull., v. 82, no. 2, p. 515-521, illus., 1971.

Earthquake focus depth contours delineate undulating surfaces which may represent the tops and bottoms of lithospheric plates 50 to 75 km thick, dipping beneath island arcs. The same data can be contoured as a single surface only with difficulty and with anomalous points. Active volcanoes lie above axes of undulations which plunge down the slope of the surface. — Authors' abstract

Stone, David B. *See* Cameron, Christopher P. 07642

Strimple, H. L. *See* Burdick, D. W. 00287

Strimple, H. L. *See* Burdick, D. W. 07555

07326 **Stude, Gerald R.** Application of paleobathymetry in exploration, *in* Exploration concepts for the Seventies: Gulf Coast Assoc. Geol. Socs. Trans., v. 20, p. 194-200, illus., 1970.

Ecological studies of living Foraminifera provide an accurate framework for paleobathymetric interpretations. Exploration for hydrocarbons can be greatly improved if these interpretations are utilized by the geologists together with standard stratigraphic and structural methods. Paleobathymetry can be used in: (1) interpreting geological history of an area, (2) demonstrating sea-floor topography and establishing the time of growth and burial of topographic highs, (3) determining faults, unconformities, amount of uplift or subsidence, (4) correlations, and (5) determining the relationship to sand deposition, abnormal pressure, and accumulation of hydrocarbons. This relationship can be derived by plotting paleobathymetry on cross sections and constructing bathymetric, tectonic, structure and isopach maps. — Author's abstract

00307 **Sturm, Edward.** Subaqueous slump structures: Geol. Soc. America Bull., v. 82, no. 2, p. 481-483, illus., 1971.

Curved, grading into planar, discordant slump scar surfaces are not uncommon in sedimentary rocks. It is suggested that the slump movement took place penecontemporaneously with the processes of sedimentation and in response to loading imbalances due to the presence of a slope. The curvature of the slump surface may be derived by resolving the vector representing the displacement, or offset, and relating its vertical components to the volume decrease associated with void ratio reduction. The particular shape of the surface is largely a function of the clay mineral content of the sediments. — Author's abstract

07446 **Su, Y. L.; Wang, Y. J.; Stefanko, R.** Finite element analysis of underground stresses utilizing stochastically simulated material properties, Chap. 15 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 253-266, illus., tables, 1970.

A new approach is described to the solution of stress distribution around underground openings using the finite element method and employing stochastically simulated rock properties. A long circular opening subjected to plane strain in a hydrostatic stress field was chosen as an example to illustrate the approach. The method is a generalization of standard structural analysis procedures in which the continuum is an assemblage of 'elements' interconnected at nodal points. In this study, individual elements were assumed to be isotropic, homogeneous and elastic, but values for Young's modulus and Poisson's ratio were randomly varied from element to element according to an assumed frequency distribution. — VSN

Sunada, Daniel K. *See* Reddell, Donald Lee. 07631

07238 **Surdam, Ronald C.** The petrology and chemistry of the Karmutsen Group volcanic rocks: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 9-12, illus., table, 1970.

The primary mineral chemistry of the Triassic Karmutsen Group volcanic rocks of central Vancouver Island, British Columbia, is characterized by striking compositional variations. These variations reflect inhomogeneities in the original bulk composition. It is suggested that the Karmutsen Group volcanics, a classical suite of eugeosynclinal rocks, were originally tholeiitic. — Author's abstract

Sutherland, J. G. *See* Crawford, C. B. 00298

07217 **Swain, Frederick M.** Non-marine organic geochemistry: Cambridge, England, University Press, 445 p., illus., tables, 1970.

This textbook, written by a geologist, presents a summary of knowledge of nonmarine organic geochemistry, presently available in books on organic geochemistry, sedimentology, and limnology. Chapter headings are: introduction to study of organic sediments; biogeochemical field and laboratory analyses; characteristics and bitumens of nonmarine sediments and sedimentary rocks; protein amino acids, carbohydrates, organic pigments of nonmarine deposits; organic acids in nonmarine deposits; organic geochemistry of nonmarine humus and nonmarine coal; and geologic history of nonmarine organic matter. A 31-page bibliography and author and subject indexes are included. — MCM

Swanston, D. N. *See* Barr, D. J. 07234

Syers, J. K. *See* Jacobs, L. W. 07431

Sykes, C. Ronald. *See* Statler, Anthony T. 07654

07443 **Tamuly, A. L.; Phukan, K. Y. Lo; LaRochelle, P.** Stresses and deformations of vertical slopes in elasto-plastic rocks, Chap. 11 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 193-212, illus., 1970.

The actual behavior of rocks in natural or excavated slopes depends on type of rock and confining pressure. In this study, the stress-strain relation is assumed to be elastic, perfectly plastic for determination of stresses and deformations in a vertical slope of soft rock. The two methods of solution used are the lumped parameter model and the finite element method. Results from both methods agree reasonably well. The normalized maximum shear-stress distribution is characterized by a "butterfly" pattern of stress concentration at the corner of the slope similar to the case of elastic solution; for the case studied, plastic flow occurs around this region. A zone of tension stress occurs at the crest of the slope extending to near the plastic zone, and the displacement pattern of the slope due to self-weight only is downward and towards the face. — VSN

07379 **Tanner, James Thomas.** The determination of antimony in natural materials by neutron activation [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 1770B, 1970.

07139 **Taylor, Charles L.** Geometric analysis of geological separation for slope stability investigations: Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 67-85, illus., 1970.

The stability of a jointed rock mass depends upon the bond between the geological separations, water condition, slope geometry, and geometry of the planes of weakness. However, an approximate empirical solution to slope stability can be attempted once the geometry of the planar features and their relationship to the proposed slope has been determined. The purpose of this paper is to present a graphical method for geometric analysis of geological separations and their relationship to slope orientation and inclination, and to determine the direction and angle of potential movement along the geological separations within a rock slope. The geometric analysis of several cut slopes within the Orinda formation of Contra Costa County, California, will be discussed and potential errors in gathering field data, plotting and manipulating data, and interpreting geometric diagrams will be indicated. — Author's abstract

07187 **Taylor, Dwight W.** West American freshwater Mollusca — [Pt.] 1, Bibliography of Pleistocene and Recent species: San Diego Soc. Nat. History Mem. 4, 73 p., 1970.

The area covered is North America from the eastern edge of the Rocky Mountains and of the Plateau of Mexico to the Pacific Ocean, also the Rio Grande drainage basin and much of southern and central Texas. The characteristically fresh-water fauna of both native and introduced species is the main focus; marginal groups are included. Geologic papers are cited if they record Pleistocene fossils, or pre-Pleistocene occurrences of species now living in western North America. Bibliographies of individual zoologists and some general bibliographies are listed separately as sources. In the main bibliography, generally only primary sources are cited — papers that contain first-hand observations, descriptions, original illustrations, or locality records. There are separate indexes for archeology, geographic distribution, parasitology (subdivided), and the strand fauna. — VMJ

07207 **Taylor, G. C.; MacKenzie, W. S.** Devonian stratigraphy of northeastern British Columbia [with French abs.]: Canada Geol. Survey Bull. 186, 62 p., illus., tables, 1970.

Five lithologically distinct Devonian rock units are recognized within the report area, and new formational names are proposed for all except an uppermost previously

named shale sequence, the Besa River Formation. Lower Devonian strata, resting unconformably on Silurian rocks are divided into the Muncho-McConnell Formation and an overlying Wokkpash Formation. Middle Devonian beds, separated from underlying strata by a disconformity, are subdivided into: lower, Stone Formation, middle Dunedin Formation, and overlying shales of the Besa River Formation. The overlying Besa River Formation is from 1,000-3,000 feet thick and contains fossils of Middle and Late Devonian and of Mississippian age. Both lower and upper contacts are diachronous. — *from* Authors' abstract

Taylor, George S. *See* Saxena, G. S. 07223

Taylor, R. M. *See* Blackburn, G. 07513

Taylor, Ronald S. *See* Davis, Darrell E. 07335

07496 **Teichert, C.** Barrande cephalopod type species: Čas. Mineralogii a Geologii, v. 15, no. 1, p. 44-52, illus., tables, 1970.

J. Barrande, in his volumes on early Paleozoic fossils of Bohemia (1852-1881), described 1622 species of cephalopods, which he assigned to 25 genera, of which 10 were established by him, based essentially on shell form. Of the total species, practically all "nautiloids," 851 were assigned to *Orthoceras* and 373 to *Cyrtoceras*. As of 1968, 80 genera had been named that had type species named and described by Barrande; 22 genera were named by Hyatt (1884-1900), 21 by Foerste (1921-1938), 10 by Flower since 1938, and 18 by other authors. These genera, including many North American species, represent all current "nautiloid" orders but Endocerida; 20 have been chosen as types for families, and two as types for orders. Except for Horny, none of the authors had access to Barrande's type specimens; all of these should be restudied by modern techniques to provide more accurate definition of the taxa based on them. — VMJ

07362 **Terlecky, Peter Michael.** The origin, stratigraphy, and post depositional history of a late Pleistocene marl deposit near Caledonia, New York [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2067B, 1970.

07632 **Thibault, Camille.** Clermont township, Abitibi-West county [also French edition]: Quebec Dept. Nat. Resources Geol. Rept. 138, 45 p., tables, geol. maps, 1970.

This township, within the intruded metavolcanic band in which several Abitibi mines are located, is crossed in the south by a detrital sedimentary band. Isoclinally folded, all area rocks are Precambrian; elongate outcrops in parallel bands trend N. 70° W. Petrologic description of rock units includes microscopic features. Regional metamorphism does not exceed greenstone facies but, in contact with larger diabase dikes, has thermal metamorphism imposed upon it; intermediate volcanics intruded by granite are partly recrystallized to amphibolite. The longitudinal shear zone of nearby Normétal mine crosses Clermont township, but schistosity conceals distinctive effects of faulting and folding; its outcrops contain disseminated or weakly concentrated sulfides, chiefly pyrite with chalcopyrite and pyrrhotite, a little galena and sphalerite, and some gold and silver. Geochemical analyses of Cu, Zn, Mn, and Mo in stream sediments are tabulated. — GDC

07184 **Thorpe, R. I.** Geological exploration in the Coppermine River area, Northwest Territories, 1966-1968: Canada Geol. Survey Paper 70-47, 150 p., tables, 1970.

The Coppermine River area, long-known for its native copper showings, was extensively staked between 1966 and 1968 and geological exploration was extremely active. This report consists of summaries of the work carried out on 121 properties and to a large extent is based on technical reports submitted by the various companies. — Author's abstract

07377 **Thurmond, John Tydings.** Lower vertebrates and paleoecology of the Trinity Group (Lower Cretaceous) in north central Texas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2156B, 1970.

Timko, Donald J. *See* Fertl, Walter H. 00275

Timmons, D. R. *See* Latterell, J. J. 00316

07633 **Tiphane, Marcel.** Gypsum deposits of the Magdalen Islands: Quebec Dept. Nat. Resources Spec. Paper 7, 27 p., illus., 1970.

Gypsum deposits were recently surveyed on the islands of Havre Aubert, Cap aux Meules, Havre aux Maisons and Entree. The deposits studied occur in the lower member (Cap Adele) of the Havre aux Maisons Formation of Mississippian age, but gypsum is also noted in its upper member which outcrops only in southern Entree. The Cap Adele rocks are predominantly of volcanic origin — brecciated lavas, pyroclastics, tuffs, and agglomerates — interbedded with argillites or shales. The gypsum of most interest is granular, in strongly deformed, stratified layers a few feet thick in upper Cap Adele Member. Two other varieties were seen only on cliffs near the seashore: fibrous satin spar, in small veins on the sides of gypsum strata in argillite; and selenite sheets, in druses and more rarely within the gypsum strata. — GDC

07189 **Todd, Ruth.** Recent literature on the Foraminifera: Cushman Found. Foram. Research Contr., v. 21, pt. 4, p. 168-176, 1970.

Toksoz, M. Nafi. *See* Minear, John W. 07311

Toots, Heinrich. *See* Voorhies, M. R. 07237

07551 **Trask, N. J.** Geologic map of Apollo landing sites 3 and 3R — Part of Oppolzer A region, Sinus Medii: U.S. Geol. Survey Misc. Geol. Inv. Map I-621 [ORB II-8 (25)], scale 1:25,000, separate text, 1970.

Imbrian mare materials which make up the oldest geologic unit of the Oppolzer A region are not exposed at the surface but are covered with a layer of fragmental debris. Two well-defined mare ridges are interpreted as lava flows that were extruded along fissures at the close of deposition of the Imbrian mare material. — MCM

07137 **Trautwein, William B.** Use of water temperature study to define seepage paths: Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 11-20, illus., tables, 1970.

A method that uses water temperature to help determine paths of underseepage of reservoir water through a dam utilizes an electric-resistance thermometer that indicates temperatures from 0-122° F with a sensitivity of 0.5° F. Temperatures of the reservoir from top to bottom, as well as any seeps downstream of the structure, must be determined, making it possible to draw isotherms. Used in conjunction with standard piezometric studies, this method was successful in defining the zone of underseepage on Alvin R. Bush Dam in central Pennsylvania, where piezometers showed seepage near the left abutment. Water temperature study established that: seepage was from the foundation rock into the embankment, jointing controlled the seepage path which was relatively direct, and seepage occurred within the top 15 feet of the foundation rock. — *from* Author's abstract

07372 **Trent, Donald Eugene.** High pressure synthesis and influence of pressure on cation distribution in 2-3 and 2-4 spinels [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2152B, 1970.

00271 **Tuman, V. S.** Terrestrial spectroscopy by a cryogenic gravity meter: Nature, v. 229, no. 5287, p. 618-621, illus., tables, 1971.

A new cryogenic gravity meter is described, which has recorded a large number of spheroidal oscillations of the Earth over three different periods. Close analysis of the data shows that the instrument can detect spheroidal oscillations due to earthquakes of magnitudes 7, 6, and 5.5 and possibly more subtle continuous effects such as energy coupled to these modes by the lunar tide, and so on. — DBV

07363 **Turner, Nell Lee.** Carboniferous stratigraphy of western San Saba County, Texas [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2068B, 1970.

Untersteiner, Norbert. *See* Maykut, Gary A. 00277

07208 **U.S. Geological Survey.** Annual report on ground water in Arizona, spring 1969 to spring 1970: Arizona Land Dept. Water-Resources Rept. 43, 44 p., illus., table, 1970.

The Basin and Range lowlands province contains more than 90 percent of cultivated land in Arizona, more than 80 percent of the population, but comprises about 45 percent of the State. Large amounts of ground water are pumped each year and water levels are declining in a large part. The Central highlands province, the smallest of the three, has only a few thousand acres of land under cultivation, so the amount of ground water pumped is small. The plateau uplands province has about 35,000 acres under cultivation, and except for a few population centers, use of ground water is confined to scattered farms and homesites. Maps, graphs, and a table show collected data during this water year. — MCM

Vallier, Tracy. *See* McManus, Dean A. 07143

Vallier, Tracy. *See* McManus, Dean A. 07249

07145 **Vallier, Tracy L.** Grain size analysis, Chap. 14 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 421-430, illus., table, 1970.

One sample of 10 cubic centimeters was taken from each opened section of cores from the Deep Sea Drilling Project, Leg 5, Dan Diego to Honolulu. The methods, in general, consist of sediment dispersal in Calgon solution using an ultrasonic probe, sieving the sand fraction, and pipetting the silt and clay fractions. Results are discussed for each site, shown in triangle diagrams, and tabulated. Clay-sized or fine-grained components predominate. — ESL

07146 **Vallier, Tracy L.** Carbon carbonate results, Chap. 15 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 431-440, table, 1970.

Methods used to determine the percentages of total carbon, organic carbon, and calcium carbonate were described in the report on Leg 1. Carbon-carbonate results are discussed by sites, and tabulated in an eight-page table. High carbonate in nannofossil oozes contrasts with the low carbonate of red clays, radiolarian oozes, and turbidite sands. Carbonate percentages in green muds range from zero to 85.5 percent. Total carbon content ranges from zero to 9.4 percent, and organic from zero to 1.4. — ESL

07154 **Vallier, Tracy L.** Volcanism, Chap. 24 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 531-534, tables, 1970.

Within the terrigenous sequences of the northeastern Pacific Ocean basin, volcanism has contributed only a small part of the sediments. This chapter deals with the major volcanic materials cored during the Leg 5 cruise. Depths and probable ages are given for ash beds and pumice fragments. Modal analyses of five basalts are presented, ages were determined from magnetic anomalies and paleontologic ages of overlying sediments. A number of questions that cannot be answered with available data are listed. — *from* Introduction

07252 **Vallier, Tracy L.** The mineralogy of some turbidite sands from sites 32 and 35, Chap. 25 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 535-539, tables, 1970.

Four samples were selected from cores at Site 35, and one from the top of Site 32 to study differences in mineralogy between sands at the two sites, on opposite sides of the Mendocino and Pioneer fracture zones, and to determine possible source areas. Sands at both sites are Pleistocene; if lithified they would be examples of lithic and arkosic wackes. At Site 32, sediments from the Delgada deep-sea fan are overlapping and burying abyssal hill topography; Site 35, in the medial valley (Escanaba trough) of the Gorda Ridge, has high sedimentation rates. Important compositional changes occur in the turbidite sands with depth in a single hole. Diversity of sands at Site 35 reflects the different source rocks. Turbidity currents were generated in different places along the Oregon-California coast, probably during lower sea level. — ESL

07514 **VanDenburgh, A. S.; Glancy, Patrick A.** Water-resources appraisal of the Columbus Salt Marsh-Soda Spring Valley area, Mineral and Esmeralda Counties, Nevada: Nevada Div. Water Resources, Water Resources-Reconn. Ser. Rept. 52, 66 p., illus., tables, 1970.

This 1,940-sq-mi area is in the southwestern part of the Great Basin, encompasses 13 valleys; a table summarizes the quantitative hydrologic character of each valley. Successful wells (1968) yield ground water solely from the alluvium at depths that generally range from 30-300 feet; ground-water withdrawals are less than 5-10 acre-feet per yr in all but eastern Soda Spring Valley where they are about 30 acre-feet per yr. Chemical quality of water is highly variable, even within a single valley. Sampled ground water in Columbus and Rhodes Salt Marsh Valleys is characteristically the least suitable for domestic and agricultural use, whereas most water in other valleys is generally acceptable. In some places excessive fluoride is or may be a problem for domestic use. — *from* Authors' abstract

07452 **Varnes, D. J.** Model for simulation of residual stress in rock, Chap. 22 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 415-426, illus., 1970.

Rocks in mines, quarries, and outcrops often show evidence of being under stress far in excess of loads from overburden, topographic irregularities, or stress concentrations around openings. In this paper, residual stresses that remain in a rock body aside from effects of gravity or temperature even after boundaries are freed from load are discussed. Granite and sandstone are examples in which balance is achieved between expansive forces in interior of crystalline grains and those of restraint at grain boundaries or in cement. If restraint is lessened by weathering, chemical alteration, or gradual slip along grain boundaries, expansive forces cause the rock to change size and shape to attain equilibrium. A simple physical model designed to understand this process is described. It is composed of units representing grains or crystal in a rock, capable of exerting repulsive forces on each other when groups are compressed. — VSN

00254 **Verduin, Jacob.** Field guide to lakes — Earth Sci. Curriculum Proj. Pamph. Ser. PS-8: Boston, Mass., Houghton Mifflin Co. (*for* Am. Geol. Inst.), 46 p., illus., table, 1971.

In terms of geologic time, lakes are very short-lived features. Radiocarbon dates on bottom sediments suggest that the oldest lakes are only about 5,000 years old. The damming of water-eroded ravines, glacier gouged basins, and basins left as lowlands excavated by wind, account for many lakes. Other rare forms are oxbow lakes, crater lakes, and limestone sinks. A series of questions to aid in determining the origin of a lake is given. Measurement of the seiche period, particles suspended in water, and the light energy supply are discussed. Testing the water with phenolphthalein to determine the food source is explained. Evaporation experiments are suggested. The microscopic community forms the base of a pyramid of food levels. Changes man has brought to this environment are reviewed. Ten questions to be used after the field trip are included. — ESL

07309 **Verma, R. K.; Hamza, V. M.; Panda, P. K.** Further study of the correlation of heat flow with age of basement rocks, *in* Geothermal problems — Symposium, Madrid,

Spain, 1969, Proc.: Tectonophysics, V. 10, nos. 1-3 (Spec. issue), p. 301-320, illus., tables, 1970.

The present paper is a continuation of the earlier paper suggesting that heat flow values taken all over the world seem to be correlatable with age of the latest phase of igneous activity of the region. This relation has been further studied for eighty reliable values of heat flow from the continents of North America and Australia. The heat flow values all over the world plotted against corresponding age suggest an exponential decay relationship. The value of "heat flow decay rate" found is $4.31 \pm 0.7 \times 10^{-10}$ which is very close to that of ^{40}K. This result points to the possibility that ^{40}K has played a significant role as heat producing element for the Earth. — Authors' summary

00263 **Vernon, James W.** (and others). Larry A. Headlee (1938-1970): Am. Assoc. Petroleum Geologists Bull., v. 55, no. 1, p. 132-133, portrait, 1971.

07511 **Vernon, R. O.** The beneficial uses of zones of high transmissivities in the Florida subsurface for water storage and waste disposal: Florida Bur. Geology Inf. Circ. 70, 39 p., illus., tables, 1970.

This report discusses present and future problems of water supply and waste disposal in Florida, especially along the coasts where urban sprawl is multiplying the fastest. The Floridan aquifer of permeable limestone and dolostone depresses the salt water which lies below it. Along the contact of the water bodies lie huge cavernous areas with high transmissivities whose mechanism of formation is still in question. Deep injection wells for waste disposal should terminate in these zones which are filled with saline unuseable water and are separated from useable water by dense sediment with low or minimal vertical transmissivity. The six deep injection wells currently in use in Florida are described and specifications for test wells are given. The possibility of storing fresh water in upper zones of transmissivity and of disposing of wastes in the lower zones is discussed. — EH

Vincent, C. Linwood. *See* Howard, Alan D. 07465

07540 **Vineyard, Jerry D.** Bibliography of the geology of Missouri, 1969: Missouri Geol. Survey and Water Resources Inf. Circ. 23, 44 p., 1970.

07226 **Volk, G. M.; Hensel, D. R.** Aggregation of mineral and organic matter in Rutlege, Ona, and Leon fine sands of the southeastern coastal plains: Soil Sci., v. 110, no. 5, p. 333-338, tables, 1970.

The productivity of sandy Florida soils often decreases during the first few years after being brought under intensive tillage. In the tilled soil, it was found that the fine mineral and organic matter existed as fillings and coatings on sand grains. In the virgin soil, the mineral and organic matter existed independently as aggregates and the sand grains were relatively clean. The aggregation of the virgin soil probably is the major factor contributing to the higher structural stability and plant tolerance to excessive soil moisture. — JWH

07153 **vonderBorch, C. C.** Glassy objects in deep sea clays, Chap. 23 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 525-529, illus., table, 1970.

Dark-colored glassy objects resembling microtectites or small lapilli were found in Tertiary deep-sea clay deposits at Site 32 of Leg 5, Pacific Ocean. One clear glassy spherule containing bubble cavities was found at Site 37, in upper Pliocene sediments. They occur only in deep-sea clay associated with zeolites, scattered shards, and traces of mica and feldspar. Spheres are the most common shape, with teardrops next; no aerodynamic disks have been found. Mineralogy and refractive index suggest a composition like basaltic glass. They appear to be concentrated in the vicinity of the last magnetic reversal so may be related to the Australian and Indian Ocean tektites. — ESL

07155 **vonderBorch, C. C.; Rex, R. W.** Amorphous iron oxide precipitates in sediments cored during Leg 5, Deep Sea Drilling Project, Chap. 26 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 541-544, illus., 1970.

Sediment at Sites 37, 38, and 39 of Leg 5 is a dark brown unconsolidated mud, composed in part of a noncrystalline iron oxide mineral. Similar deposits have been described in areas of high-heat flow near the crest of the mid-ocean ridge system or related rifts. Such a metal-rich facies would be expected to occur as a basal deposit overlying basaltic oceanic basement, but this occurrence is remote from a present-day ridge system. Three distinct facies were recognized in all three holes: basal amorphous iron-manganese oxide facies, mixed amorphous iron-manganese oxide-detrital facies, and detrital facies. Observed stratigraphic and mineralogic relations are best explained by the sea-floor spreading hypothesis. The ridges may subsequently have been overridden by the continental plate. — ESL

vonderBorch, C. C. *See* McManus, Dean A. 07249

vonderBorch, Christopher V. *See* McManus, Dean A. 07143

07237 **Voorhies, M. R.; Toots, Heinrich.** An unusual burrow of a Tertiary vertebrate: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 7-8, illus., 1970.

A large fossil burrow (perhaps the largest recorded) occurs in the unconformity between the late Tertiary Ash Hollow Formation and the Cretaceous Niobrara Formation at Medicine Creek Dam, Frontier County, Nebraska. A large fossorial rodent (e.g. *Epigaulus*) or a medium-size carnivore (e.g. *Pliotaxidea*, *Leptocyon*) was probably responsible for digging it. — Authors' abstract

07535 **Wagner, Frances J. E.** Faunas of the Pleistocene Champlain Sea [with French, German, and Russian abs.]: Canada Geol. Survey Bull. 181, 104 p., illus., tables, 1970.

The Champlain Sea covered parts of the present Ottawa-St. Lawrence Lowland from about 11,500 years B.P. to between 8,000 and 9,000 years B.P. Published references (1837-1966) to the faunas, and a fossil list, have been compiled by Wagner (1967). In this report, more than 100 species (none new) identified by the author from recent work are described and illustrated, predominantly foraminifers, gastropods, pelecypods, and ostracodes. A few shells have been radiocarbon dated. The fauna indicates a shallow sea, with salinity ranging from almost fresh in the upper Ottawa River and Lake Champlain areas to more nearly marine in the Quebec City area. Water temperatures were boreal in the earlier stages and later became more temperate; an attempt to establish precise paleotemperatures by O-18 analysis was not successful. Fossil localities and stratigraphic data are listed in appendixes. — VMJ

07562 **Wagner, W. R.** Characteristics and depositional environments of the rocks of Allegheny County, [Chap.] 3 *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 8-40, illus., 1970.

The rocks of Allegheny County are horizontally-layered sedimentary rocks of three types: clastic rocks, mainly sandstone, siltstone, shale and claystone; limestone and dolomite, precipitated from lake or sea water; organic rocks, such as coal and shell limestone. The depositional environments of these rocks are discussed: open-water, swamp, lake, stream and delta environments. — EH

07563 **Wagner, W. R.** Structural geology, [Chap.] 5 *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 60-71, illus., 1970.

In Allegheny County the sedimentary rocks were arched, tilted and broken but not metamorphosed. Joints divide the rocks vertically and are at nearly right angles to the horizontal sedimentary layering. Major joint directions are northeast and northwest. Faults, which interrupt the parallel pattern of rock layers, are described as visible in a railroad cut at Bakerstown Station. Folds of various sizes are also described. — EH

Wagner, W. R. *See* Heyman, Louis. 07568

07645 **Wagner, W. R.** Stratigraphy, [Chap.] 4 *in* Geology of the Pittsburgh area: Pennsylvania Geol. Survey, 4th ser., [Bull.] G 59 (General Geology Rept.), p. 41-59, illus., table, 1970.

The rocks of western Pennsylvania were formed during the Paleozoic Era and all systems of the era are represented in the Pittsburgh area, although most are far below the surface. Only 1,100-1,200 feet of Pennsylvanian and Permian rocks are exposed at the surface. This chapter discusses the subdivisions of the surface rocks of Allegheny County, their distribution and depositional environments, cyclothems, facies and hiatuses. — EH

Wainerdi, R. E. *See* Kuykendall, W. E., Jr. 07148

07228 **Waldron, L. J.; Manbeian, T.** Soil moisture characteristics by osmosis with polyethylene glycol — A simple system with osmotic pressure data and some results: Soil Sci., v. 110, no. 6, p. 401-404, illus., table, 1970.

Polyethylene glycol and dialyzing tube can be used to obtain soil moisture characteristics over a wide suction range. Simple units are described, and osmotic pressures (0.16 to 24.8 bars) and solution densities are tabulated for various polyethylene glycol concentrations. The characteristics for 6 California soils are presented. — JWH

Walker, E. H. *See* Crosthwaite, E. G. 07532

07591 **Walker, Kenneth Russell.** The stratigraphy, environmental sedimentology, and community ecology of the Middle Ordovician Black River Group of New York State [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1353B-1354B, 1970.

07455 **Wallace, George B.; Slebir, Edward J.; Anderson, Fred A.** Foundation testing for Auburn Dam, Chap. 25 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 461-498, illus., tables, 1970.

Rock mechanics work at Auburn damsite on the North Fork of American River northeast of Sacramento, Calif., includes experimental laboratory tests on core samples from holes drilled for geologic studies of the site and in-situ tests in selected areas. In-situ tests include uniaxial and radial jacking tests for load vs. time-deformation relations, shear and block sliding tests for cohesion and friction factors, plate-bearing test to evaluate compressibility of gouge in fault and shear zones, and stress relief tests to determine direction and magnitude of stresses in the rock mass. Laboratory work includes tests of NX cores for unconfined compressive strength, modulus of elasticity, Poisson's ratio, triaxial shear, direct shear and sliding resistance, specific gravity, absorption, permeability, porosity, solubility, and petrographic properties. — *from* Authors' summary

Wallace, William A. *See* Dunn, James R. 07482

Wang, Y. J. *See* Su, Y. L. 07446

Wang, Y. J. *See* Hardy, H. R., Jr. 07451

07498 **Warren, Charles R.** Surficial geologic map of the Winsted quadrangle, Litchfield and Hartford Counties, Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-871, scale 1:24,000, separate text, 1970.

Most surficial deposits in the Winsted quadrangle are till deposited by Pleistocene glacier ice; the remainder are stratified drift deposited by melt water from the ice. Topographic evidence suggests Pleistocene drainage changes, and a fissile till of possible pre-Wisconsin age has been found in nearby areas. Glacier ice of a late

Wisconsin advance swept the area so clean that few if any older Cenozoic deposits survived. Three short ridges seem to be analogous to retreatal moraines, each marking a temporary stillstand position of the active ice margin. When the last ice melted out, glacial Lake Winsted was formed; it was finally drained when ice melted enough to permit drainage via the present course of Still River. After the ice disappeared, streams deposited alluvium in most valleys. — MCM

07419 **Warren, Harry V.; Delavault, Robert E.; Cross, Christine H.** Base metal pollution in soils, *in* Trace substances in environmental health III — Conf. on Trace Substances in Environmental Health, 3d Ann., Columbia, Mo., 1969, Proc.: Columbia, Mo., Univ. Missouri, p. 9-19, tables, 1970.

Mineral pollutants, as elements, are present in all soils; most mineral pollution merely involves a change in proportions of specific elements in a soil. Soils usually carry somewhere in the range of 5-70 ppm of copper, 35-300 ppm of zinc, and from 2-10 ppm of lead. The trace-element content of rocks is a source of geologic pollution. Examples of mineral pollution are put into six categories: geologic, mining, industrial, automobiles, waste disposal, and chemical. Polluted soils may carry as much as 1,000 ppm of copper, lead, or zinc; also modest amounts of soil pollutants, generally unsuspected, may have some effects on human health. — ESL

07622 **Warrick, A. W.** A mathematical solution to a hillside seepage problem: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 849-853, illus., 1970.

A hillside seepage problem is treated mathematically for a nonrectangular, two-dimensional, water-saturated system. Water enters along the upper part and seeps out along the lower part of the sloping surface. The flow medium extends to an infinite depth below and is bounded on either side by vertical streamlines. An analytical solution is presented relating the complex potential to points in the flow medium. Seepage intake rates, infiltration angles, and a sample flow-net are presented graphically. — Soil brief

00270 **Washington Correspondent.** Earthquakes trigger reports but no funds: Nature, v. 229, no. 5286, p. 520-521, illus., 1971.

At least six reports on earthquakes have appeared since the Alaska earthquake of 1964, and each has arrived at broadly the same recommendations; but it remains to be seen whether the California earthquake of February 1971 will be any more effective in opening the doors of treasury vaults for research on the prediction and control of earthquakes. Both the Alaska and the recent earthquake were sparing in terms of casualties, but destructive in terms of property. It is disturbing that several of the structures destroyed in California were designed to be earthquake-resistant. — DBV

00240 **Waterhouse, J. B.** The brachiopod genus *Tomiopsis* Benedictova from the Permian of Canada: Jour. Paleontology, v. 45, no. 1, p. 68-80, illus., tables, 1971.

Tomiopsis ovulum is a new species from the Lower Permian of the Yukon Territory; *T. magna* (Campbell), originally described as *Ingelarella* from Australia and Tasmania, occurs in the Assistance Formation of Melville Island. Entry of the genus into the Canadian Permian coincides with glacial epochs in the Southern Hemisphere. *Ambikella* Sahni and Srivastava and *Ingelarella* Campbell probably are junior synonyms of *Tomiopsis*, which belongs in the family Martiniidae (subfamily Ingelarellinae) along with members of the subfamily Brachythyridinae. — REG

Wawkins, R. H. *See* Corey, J. C. 07623

07476 **Webb, William M.** Sand and gravel resources of the Ohio River valley — Lawrenceburg to Jeffersonville, Indiana, *in* Forum on geology of industrial minerals, 5th, Harrisburg, Pa., 1969, Proc.: Pennsylvania Geol. Survey, 4th ser., Bull. M64 (Mineral Resources Rept.), p. 23-42, illus., tables, 1970.

Broad Pleistocene terraces, whose surfaces stand 10 to 30 feet above the modern flood plain of the Ohio River, contain potentially valuable deposits of aggregate for

the construction and allied industries. Between Lawrenceburg and Jeffersonville, Ind., the most extensive terraces are on the inside of meanders. Coarse gravel-bearing outwash, from which a wide spectrum of aggregate materials could be produced, constitutes at least part of many of these terraces. Characteristically the coarsest material occupies the upstream end of the terraces, and the size and amount of gravel decrease downstream. Overburden consisting of fine sand, silt, and clay, generally 3 to 20 feet thick, mantles the outwash. This overburden is overlain in some places by aeolian sand as much as 25 feet thick. — Author's abstract

Weber, Walter J., Jr. *See* Mattson, James S. 07130

Weed, S. B. *See* Leonard, R. A. 07615

Weed, S. B. *See* Leonard, R. A. 07616

Weiler, James P. *See* Bonine, Michael E. 07191

07459 **Weinbrandt, R. M.; Fatt, Irving.** Scanning electron microscope study of the pore structure of sandstone, Chap. 31 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 629-641, illus., 1970.

A scanning electron microscope having variable magnification from X20 to X20,000 and about 1000 times the depth of focus of conventional light microscopes can be used to observe three-dimensional flow channels in reservoir rock. This microscope can obtain also stereoscopic images and can measure and diagram flow channels so that it is possible to construct a network of tubes that will model consolidated reservoir rock. The theory of the microscope, sample preparation, descriptions and SEM photographs of several sandstone samples, and application to network model of porous media are discussed. — VSN

Welby, Charles W. *See* Davis, Darrell E. 07335

07162 **Welge, E. A.** Olcese 12-21 pool of Greeley oil field: California Oil Fields — Summ. Operations 1970, v. 56, no. 1. p. 15-23, illus., tables, 1970.

The structure of Greeley oil field (Kern County) is a broad anticlinal fold trending NW-SE on the general Wasco-Rio Bravo-Greeley high, which extends for about 20 miles. Oldest sediments of the Olcese pool area are of lower Miocene age; the Olcese sand has been described as marine in some fields and nonmarine in others. Typical lithology of the Olcese zone consists of sandstone, with thin interbeds of siltstone and shale. Ultimate recoverable oil has been estimated at 5.3 million bbls. — MCM

07391 **Wertz, Jacques B.** Arizona's copper province and the Texas lineament: Mining Eng., v. 22, no. 5, p. 80-81, illus., 1970.

The southeast Arizona copper province is associated with 3 regional structural trends: (1) a north-northwest-trending anticlinorium, (2) northeast-trending fractures, and (3) the Texas lineament. The location and nature of much of the Texas lineament are not well defined. Movements along this structure have controlled loci for porphyry copper mineralization. The relationship of the Texas lineament to ore bodies at Bisbee, Ajo, Morenci, and Silver Bell is discussed. — MAC

Weser, Oscar. *See* McManus, Dean A. 07143

Weser, Oscar. *See* McManus, Dean A. 07249

07255 **Weser, Oscar E.** Lithologic summary, Chap. 30 *in* Initial reports of the Deep Sea Drilling Project — V. 5, Leg 5 of cruises of *Glomar Challenger*, San Diego, Calif., to Honolulu, Hawaii, Apr.-June 1969 (D. A. McManus and others): Washington, D. C., U.S. Govt. Printing Office, p. 569-620, illus., tables, 1970.

Terrigenous sediments occur only in those sites drilled closest to land masses, and comprise 75 percent of sediment penetrated. The main criterion for differentiating pelagic from terrigenous deposits was color. Other factors are sedimentation rate, depositional processes, and distances organic matter are transported. Several seismic profiles are included. The past sedimentation record is examined in light of present conditions of bottom-current flow and nepheloid layer transport; turbidity currents, biogenous productivity, and bottom currents are identified as having had a major influence. Pelagic sediments, found at all open-ocean drill sites, vary widely in thickness, and range from early Eocene to Pleistocene. Some are coarser-grained than terrigenous deposits, their water content is greater, and can be divided into two major types, red clays and biogenous oozes. Nine sedimentation agents are described. — ESL

07454 **West, L. J.; Perry, R. M.** Rock mechanics studies for a high cut at a nuclear power station in Pennsylvania, Chap. 24 *in* Rock mechanics, theory and practice — 11th Symposium on Rock Mechanics, Berkeley, Calif., 1969, Proc.: New York, Soc. Mining Engineers, Am. Inst. Mining, Metall. and Petroleum Engineers, p. 445-459, illus., tables, 1970.

Rock mechanics studies for high cuts at a nuclear power station site along the Susquehanna River in Pennsylvania are described. The cuts on the west and north sides of the station area have a maximum height of about 200 feet; extensive stability analyses were performed prior to, during, and after excavation to evaluate the steepest angle at which the slopes could be cut. Methods of analysis were based on studies of such factors as strength of material, zones of weak material present along planes of schistosity, orientation and frequency of joints, ground water, weathering degree, and postulated seismic effects. — VSN

West, W. S. *See* Heyl, A. V. 07202

Westfall, I. *See* Sims, P. K. 07245

Wexler, James A. *See* Donahue, Jack. 07651

07635 **White, John S., Jr.; Jarosewich, Eugene.** Second occurrence of benstonite: Mineralog. Rec., v. 1, no. 4, p. 140-141, illus., table, 1970.

A second occurrence of benstonite is reported from the Minerva mine, Cave-in-Rock, Hardin County, Illinois. — EH

07141 **Wiegand, Jeffery W.** Evidence of a San Diego Bay-Tijuana fault: Assoc. Eng. Geologists Bull., v. 7, nos. 1-2, p. 107-121, illus., 1970.

A fault underlying San Diego Bay as an extension of the known Rose Canyon fault and proceeding through the Tijuana area is inferred by displacement of Pleistocene lithologic units as mapped by Peterson, Gastil, Minch, Ziony, Flynn, and myself. Geothermal activity consisting of warm water in wells has been disclosed in the south San Diego Bay and Otay Mesa areas. A gravity survey shows anomalies that further suggest the fault. The historically quiet seismic record of the area could be interpreted as a result of the fault zone being truncated or "locked-off" by transverse faults in the south San Diego Bay area. — Author's abstract

Wiens, J. H. *See* Lavkulich, L. M. 07432

07621 **Wierenga, P. J.; deWit, C. T.** Simulation of heat transfer in soils: Soil Sci. Soc. America Proc., v. 34, no. 6, p. 845-848, illus., 1970.

A computer model based on S/360 CSMP was developed to predict the temperature fluctuation in the subsoil from temperature variation at the soil surface with depth- and temperature-dependent values of the apparent thermal conductivity. Observed and predicted soil temperatures agreed for irrigated field soil profiles but not for dry soil. Predicted soil heat flux density values agreed with values calculated from temperature measurements. [Use of a digital simulation language can save considerable

programming time, and can be applied to movement of water and gases in soil profiles.] — Soil brief

07549 **Wilhelms, Don E.** Geologic map of Apollo landing site 1 — Part of Maskelyne DA region, southeastern Mare Tranquillitatis: U.S. Geol. Survey Misc. Geol. Inv. Map I-617 [ORB II-2 (25)], scale 1:25,000, text, 1970.

The Maskelyne DA region, a potential early Apollo landing site in the lunar equatorial belt, lies near the southern edge of the southeastern embayment of Mare Tranquillitatis; about two-thirds of the site has gently undulating terrain with characteristics transitional between mare and terra. This site is unique in that one unit is the smoothest, least cratered unit observed anywhere in the equatorial belt and presents problems in interpretation. A general summary of geologic maps of early Apollo landing sites by N. J. Trask is included. — MCM

07235 **Williams, D. W.; Kennedy, G. C.** The melting of jadeite to 60 kilobars: Am. Jour. Sci., v. 269, no. 5, p. 481-488, illus., tables, 1970.

The melting of jadeite has been examined both by differential thermal analysis and by quenching techniques in piston-cylinder apparatus between 30 and 60 kb. Our results agree with Bell's (1964) experimental data to 40 kb, but our curve lies at higher temperatures than his extrapolated curve above 45 kb; our corrected curve is 55°C higher at 50 kb. — Authors' abstract

07165 **Williams, P. A.** Todhunters Lake gas field: California Oil Fields — Summ. Operations 1970, v. 56, no. 1, p. 45-51, illus., tables, 1970.

Sediments in Todhunters Lake gas field range from the Upper Cretaceous Forbes Formation to Holocene alluvium. The most striking feature is the Markley Gorge which was cut during Eocene time into sediments of the early Tertiary and Late Cretaceous; its fill consists mainly of impervious shale and claystone with minor sandstones and conglomerates. The field is located on the updip side of a large regional homocline dipping SW at an average rate of 175 feet per mile. Production is obtained from seven zones, the Starkey S1 being the most prolific. Total production has been over 3 million Mcf gas. — MCM

Wilmoth, Roger C. *See* Hill, Ronald D. 07409

07612 **Wilson, Charles W., Jr.** Geologic map of the Shop Springs quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 318-NW, scale 1:24,000, separate text, 1970.

Limestone from the Carters and Bigby-Cannon are best suited for general uses and for agricultural limestone; the Cannon ranges from 80 to 120 feet in thickness in the Shop Springs quadrangle. — MCM

07613 **Wilson, Charles W., Jr.** Geologic map of the Olivehill quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 23-SE, scale 1:24,000, separate text, 1970.

Mined mineral resources of the Olivehill quadrangle are chert from the Fort Payne Formation, sand and gravel in alluvial deposits on flood plains and in beds of larger streams, and large reserve of limestone in several formations. Potential resources are iron, and dimension stone. — MCM

07544 **Wilson, Edward C.** *Conocardium langenheimi* sp.n. (Mollusca: Bivalvia) in the Lower Permian Series of the McCloud Limestone, northern California: Los Angeles County Mus. Contr. Sci., no. 184, 14 p., illus., 1970.

This new species of *Conocardium*, the cosmopolitan but only genus of the order Conocardioida, occurs in the Wolfcampian McCloud Limestone, Shasta County, Calif. It is a large shell with noncarinate posterior end, three pairs of perforate "shelves" within the gaping anterioor end, a tube enclosed dorsally in the shell layers of each valve, and unique internal hinge structures. Although the shell externally resem-

bles that of bivalves such as the Pholadidae, the microstructure appears molluscan but is unlike that of most bivalves, the functions of most of the internal features are unknown, and even the anterior-posterior orientation is uncertain. The entire Order Conocardioida needs investigation to determine the significance of these features, for reconsidering its systematic position at class or higher level. — *from* Author's abstract

07614 **Wilson, Edward C.; Bing, Donald E.** Type specimens of fossil Invertebrata in the Los Angeles County Museum of Natural History, exclusive of paleoentomology: Los Angeles County Mus. Contr. Sci., no. 181, 20 p., 1970.

Type specimens of fossil Porifera, Coelenterata, Brachiopoda, Bryozoa, Mollusca, Arthropoda (except insects), and Echinodermata in the Museum are listed by the original published names. Original reference, museum type number, age, formation, and locality are given for each specimen. Figured specimens not of the holotype or paratype groups are included. A list of the paleoentomological types of Pierce and Statz will be published separately. — *from* Authors' abstract

Wilt, Jan Carol. *See* Peirce, H. Wesley. 07209

07473 **Windley, Brian F.** Primary quartz ferro-dolerite/garnet amphibolite dykes in the Sukkertoppen region of West Greenland, *in* Mechanism of igneous intrusion (Geoffrey Newall and Nicholas Rast, editors) — Liverpool Geol. Soc. Symposium, Liverpool, England, 1969, Proc.: Geol. Jour., Spec. Issue no. 2, p. 79-92, illus., tables, 1970.

The dikes described here belong to the southernmost part of a swarm near Sukkertoppen in West Greenland, in which all major dikes consist of dolerite at the margins and garnet amphibolite along the center. The many, essentially parallel, subvertical dikes trend NNE and are usually between 20 and 5 m wide. Detailed study of interiors show that they are multiple intrusions. Narrow dikes are dolerite only, but in wider dikes dolerite passes inwards into various types of deformed dolerite and amphibolite arranged in seven parallel symmetrical layers. Rock types, modal variation and chemical compositionsare discussed. Field relations indicate that amphibolite crystallized in a late magmatic period soon after doleritic layers; the initial basic magma produced hornblende quartz dolerite, but by the time of last magma intrusions there was sufficient stress and water pressure for foliated garnet amphibolite to crystallize in central parts. — VSN

Wing, R. S. *See* MacDonald, H. C. 00202

Wingard, N. E. *See* Herbert, T. A. 07526

Wise, Sherwood W., Jr. *See* Hay, William W. 07463

07287 **Wise, Sherwood Willing, Jr.** Scanning electron microscope study of molluscan shell ultrastructures [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2771B, 1970.

07267 **Witczak, Matthew Walter.** A generalized investigation of selected highway design and construction factors by regional geomorphic units within the Continental United States (Volumes I and II) [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2670B, 1970.

Wittkopp, R. W. *See* Stephens, J. D. 07393

07416 **Wolff, Roger G.** Relationship between horizontal strain near a well and reverse water level fluctuation: Water Resources Research, v. 6, no. 6, p. 1721-1728, illus., 1970.

Measurements of radial surface strains near a pumping well showed compression near the well that changed to tension farther away from the well. A theoretical model is presented. In general, this model reproduces the measured strains. Observations of

anomalous increase in pore pressure in a clay adjacent to the pumped aquifer are related to the development of these strains. These increases in pressure are attributed to distortion of the pore space in the clay resulting from the transference of horizontal strain from the aquifer via shear. Applying a conceptual model that permits the transference of strain across confining layers to unpumped artesian aquifers account for reverse water fluctuations. — Author's abstract

00260 **Wollast, Roland; Garrels, Robert M.** Diffusion coefficient of silica in seawater: Nature Phys. Sci., v. 229, no. 3, p. 94, 1971.

The diffusion coefficient of dissolved monomeric silica in sea water of 36.1 percent salinity has been determined at 25° C, by the diaphragm cell method, as $1.0 \pm 0.05 \times 10^{-5}$ sq cm per sec. The value at sea-floor temperatures is probably about 0.5×10^{-5} sq cm per sec. The apparent diffusion coefficient for recent marine sediments having a directional diffusional porosity of about 30 percent should be about 0.3 times the value of the silica diffusion for pure sea water, or about 0.15×10^{-5} sq cm per sec. — DBV

07592 **Wood, Warren W.** Geochemistry of ground water of the Saginaw Formation in the upper Grand River basin, Michigan [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 3, p. 1354B, 1970.

Woodbury, H. O. *See* Powell, L. C. 07315

07461 **Woodfill, Robert D.** Interpretation of gravity anomalies in Precambrian rocks of the central Laramie Mountains, Wyoming: Wyoming Univ. Contr. Geology, v. 9, no. 1, p. 17-25, illus., table, 1970.

Some 300 gravity stations were established in the Squaw Rock area to determine geometric relations in Precambrian crystalline rocks — schists in plunging folds, a domal granite gneiss complex, and a syenite intrusion. The regional gradient trends NE-SW, an anomalous -3 mgal low over Squaw Peak granite gneiss is due to mass deficiency, and a +5 mgal high near the gneiss-hornblende syenite contact, to a disturbing mass beneath the syenite. A gravity model of Slate Creek area, synformal dense mafic schists, suggests the hornblende schist in George Creek synform thins with depth, and Slate Creek synform is about 0.6 km deep. West of the Squaw Peak complex, hornblende schist has a +2 mgal anomaly, a calculated 0.4 km thick, it probably continues under the syenite and causes the positive anomaly to the south. A small regional gradient in Squaw Rock area, at 90° to the large one of the Laramie Mts., could be caused by a deeper, sloping interface of gabbro-like rocks. — GDC

Woodfork, Larry D. *See* Cardwell, Dudley H. 07199

Woodruff, N. P. *See* Skidmore, E. L. 07627

Wrathall, Don M. *See* Buttgereit, Charles D. 07406

00211 **Wright, Robert H.** Lower Paleozoic autochthonous sequence in southeastern California: Geol. Soc. America Bull., v. 82, no. 2, p. 485-488, illus., 1971.

The Bonanza King Dolomite (Middle and Late Cambrian), Lead Gulch Formation (Late Cambrian), and Tamarack Canyon Dolomite (Late Cambrian) are exposed in the Front Ridge area on the west side of the Inyo Mountains east of Lone Pine, California, and represent the southwesternmost occurrences of miogeosynclinal rocks of Late Cambrian age in North America. The Bonanza King Dolomite forms the core of an elongate north-northwest-trending anticline that is the southernmost extension of a regionally significant fold in the northern Inyo Mountains. This anticlinal block is in place relative to the allochthonous northern Inyo and northern Panamint Mountains and provides evidence for a possible eastern limit for the root zone from which rocks of Late Cambrian age originated, which are included in allochthonous masses east of the Front Ridge area. — Author's abstract

00286 **Wu, Dah Cheng.** Origin of greenish-gray spots and layers in the upper Flowerpot Shale (Permian), northwestern Oklahoma: Oklahoma Geology Notes, v. 31, no. 1, p. 3-10, illus., tables, 1971.

Based on data from quantitative analyses of iron and silicon by X-ray fluorescence, emission-spectrographic analyses of the trace elements cobalt, nickel, and vanadium, and size analyses by pipette method, the greenish-gray spots and layers in the red-bed sequence of the upper Flowerpot Shale (lower Guadalupian) are attributed to the reduction of ferric iron oxides to the ferrous state by oxidation of organic matter. In addition, the circulation of solutions in the more permeable siltstone and silty shale units is believed to be responsible for the reduction in total iron content of these greenish-gray units. — *from* Author's abstract

07609 **Yamanaga, George; Huxel, C. J., Jr.** Preliminary report on the water resources of the Wailuku area, Maui: Hawaii Div. Water and Land Devel. Circ. C61, 43 p., illus., tables, 1970.

This report summarizes available data on the geology, rainfall, streamflow and ground-water occurrence, discharge and quality in the Wailuku area of West Maui. Water is normally plentiful, and a large part of the available supply is exported to adjacent areas. Perennial streams, except Makamakaole Stream, derive their base flows from water draining from high-level, dike-held, ground-water bodies in West Maui Mountain. The largest streams, Waikapu and Waiehu, supply large amounts of water for irrigation. Ground water also occurs as basal and perched water. Additional water could be obtained from a basal-water body in the area between Waikapu and Waihee Valleys. — EH

07373 **Yang, Houng-Yi.** Phase equilibria of the join akermanite-anorthite-forsterite in the system CaO-MgO-Al_2O_3-SiO_2 at atmospheric pressure [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2152B, 1970.

07466 **Yang, Jung Hsi.** Behavior of anisotropic rocks under combined stresses [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 4, p. 2023B, 1970.

07211 **Yemel'yanov, Ye. M.; Litvin, V. M.; Kharin, G. S.** Ekskursiya v krater vulkana [Excursion to a volcano crater]: Priroda, no. 10, p. 90-93, illus., 1970.

The authors give a general description of the island of Montserrat in the Lesser Antilles and of the hot springs in the crater of Soufriere Volcano. A chemical analysis of water samples showed a high phosphate and manganese content. The rocks in the area of the geothermal field show considerable hydrothermal alteration and are chiefly composed of allophane. X-ray analysis of rock samples shows the presence of kaolinite and alunite, with some grains of feldspar and pyroxene. The authors conclude that the activity of the volcano has diminished, but that it is not extinct and could produce a catastrophe similar to that which occurred on Martinique. — EH

00242 **Yochelson, Ellis L.** The little-known Pennsylvanian *Clavulites* reinterpreted as a "worm": Jour. Paleontology, v. 45, no. 1, p. 126-129, illus., 1971.

Clavulites Girty, 1904, from the Upper Pennsylvanian of Kansas, was described as a scaphopod, but the taxon has been overlooked in later classifications of Scaphopoda. Details of the morphology suggest that this form is better assigned to the "worms" than to the Mollusca. — Author's abstract

00309 **Yochelson, Ellis L.** The Permian nautiloid mandible *Rhynchoteuthis kaibabensis* reinterpreted as a polyplacophoran: Jour. Paleontology, v. 45, no. 1, p. 130-133, illus., 1971.

Rhynchoteuthis kaibabensis Brady, from the Kaibab Limestone of Arizona, has been incorrectly assigned. The three known specimens are polyplacophoran plates, not triangular-shaped cephalopod mandibles. The species is transferred with question to *Cymatochiton*. — Author's abstract

Zeltlin, Harry. *See* Armitage, Bruce. 00261

07292 **Zengeni, Teddy Godfrey.** PKKP and the fine structure of the Earth's core [abs.]: Dissert. Abs. Internat., Sec. B, Sci. and Eng., v. 31, no. 5, p. 2474B, 1970.

Zerneke, K. L. *See* Kruse, G. H. 07442

Zieske, Scott H. *See* Hogan, Edward Patrick. 07192

07494 **Zinsmeister, William J.** A Late Pliocene macrofossil fauna of Newport Beach, Orange County, California: Southern California Acad. Sci. Bull., v. 69, nos. 3-4, p. 121-125, table, 1970.

A marine fauna of mollusks and fishes has been recovered from a new exposure of an unnamed upper Pliocene sandstone in a cliff bordering the south side of Newport Lagoon. Forms identified as to species or genus are listed: one brachiopod, 46 gastropods, 2 scaphopods, 31 bivalves, and 16 fishes. General composition of the molluscan fauna suggests a water depth of between 20 and 100 fathoms for the deposit; inference of a moderately deep-water habitat is supported by common presence of outer neritic fishes. Presence of a few shallow-water mollusks and a shallow-water fish, all showing more erosion and breakage than the deeper-water forms, suggests that these were reworked and mixed with the deeper-water fauna. The Newport Lagoon fauna is closely similar in composition to the Lomita Marl fauna of Palos Verdes Hills, which is currently considered latest Pliocene in age. — VMJ

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